2014

Predictive Validity of the Individual Growth and Development Indicators: Examination of Students who Attend Head Start

Erin Sarah Leichman
Lehigh University

Predictive Validity of the Individual Growth and Development Indicators:

Examination of Students who Attend Head Start

by

Erin S. Leichman

Presented to the Graduate and Research Committee

of Lehigh University

in Candidacy for the Degree of

Doctor of Philosophy

in

School Psychology

Lehigh University

Erin S. Leichman

Approved and recommended for acceptance as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy (Doctor of Education).

Date

Dissertation Director
Edward S. Shapiro, Ph.D.

Professor of School Psychology

Date

Committee Members

Grace I. L. Caskie, Ph.D.
Associate Professor of Counseling Psychology

Robin L. Hojnoski, Ph.D.
Assistant Professor of School Psychology

Patricia H. Manz, Ph.D.
Associate Professor of School Psychology

Kristen Missall, Ph.D.
Associate Professor
University of Iowa, College of Education

Acknowledgements

I am honored to have the opportunity to formally acknowledge several people who have supported me as I completed my graduate degree. I must first thank my adviser, Dr. Edward S. Shapiro. Since August 2006, you have been one of the most consistent and persistent individuals in my life. Thank you – so very much – for all of your support, whether in the form of academic feedback and instruction, general life guidance, or just plain nudging. Please know that I will always appreciate it – in all of its forms. I could not have done this without you! Your love for and dedication to not only the field but also your students is truly admirable.

I would also like to thank the members of my dissertation committee, Drs. Grace Caskie, Robin Hojnoski, Patricia Manz, and Kristen Missall. I wholeheartedly value your individual and collective expertise, guidance, and instruction I experienced throughout the dissertation process. You are all brilliant researchers, dynamic professors, and incredible role models. Thank you! And, to Drs. Gary Lutz and Joan (Qiong) Fu, thank you for all of your time and input!

I must also enthusiastically mention Dr. Jodi A. Mindell, without whom I would not have completed my degree. Your personal and professional mentorship has been invaluable. It has been an honor and a privilege to work with you. Words cannot express my gratitude. I am so glad our paths have crossed! I would also love to thank Dr. John Galligan for believing in me and providing consistent and well-needed comic relief. To Dr. Christine Novak, you have been an incredible source of support, humor, and reality – thank you.

To my family who are friends and friends who have quickly become family, thank you for all of your levity, love, patience, and support. In no particular order, thank you to the following: Sabrina Terrizzi, Keith Erekson, Laurie Mickaliger-McBride, Aldo Burrascano, Alban Bailey, Elizabeth Shephard, Kristin McGrath, Katherine Gilligan, Heather and Paul

Giurlando, Brigid Vilardo, Sean O'Dell, Sarah Gebhardt, Kathleen Semeniak, Cheyenne Hughes-Ried, Jaime Benson, Catherine Bracaliello, Erin McCurdy, Lisa Thomas, Kirra Guard, Vanessa Pressimone, Jocelyn Helwig, Lindsey Brooks, Rebecca Klinger, Matthew Malouf, Evan Dart, Shasta Ihorn, Jennifer Koehler, Tera Bradley, David Klingbeil, Kacey McNally, Michelle Troxler, George Hebert, Kelvin Sanborn, Ari Kristan, Kristin Sternowski, Ilina Chaudhuri, Steve Holloman, Sarah and Johnny Zohir, Nikki Falcone and Jerry, Donna Clapp, Bernie Barboza, Sharon Warden, Greg Gallagher, Isabel Zimmerman, Yvonne Bonnette, all of my Tufts girls, and my New Orleans Lemann Family (Elizabeth, Alex, Jack, Sparkle, Harley, Cathy, Jerry, and Leslie).

Last but certainly not least, to my mother (Maureen), brother (Stephen), extended family (Allen Tiska and Armena Vahradian), and late grandparents (Mary and Andrew Scrobola), I owe thanks for understanding, loving, and supporting me for much longer than the seven years it took to finish my graduate degree! To Lydia Sullivan and Stephanie Barney, thank you for the care packages, visits, road trips, late night chats, meals, concerts, holiday cheer, patience, and homes away from home. I have known you both for over a decade and hope to know you for several more. You kept me going in ways you don't even know! Thank you! To Ilena Key – what a journey. Thanks for being one of my best sounding boards and always reminding me of my marathon…as opposed to my sprint. I love you all.

Table of Contents

List of Tables

List of Figures

Abstract

The purpose of the current study was to explore the predictive nature of emergent literacy skills assessed utilizing the Individual Growth and Development Indicators (IGDIs; Early Childhood Research Institute on Measuring Growth and Development, 2000) prior to kindergarten entry on subsequent early literacy skills obtained through administration of Dynamic Indicators of Basic Early Literacy Skills (DIBELS,*6th Edition*; Good & Kaminski, 2002) during kindergarten. The study was conducted with a group of 94 students who attended Head Start, some of whom were considered Dual Language Learners, having a Primary Language Status (PLS) other than English. Potential predictive bias of the IGDIs on the DIBELS based on parent-reported primary language status (i.e., Primary Language English or Primary Language as Other) as well as performance on specific literacy variables based on language status were also assessed. Overall results indicated that IGDIs were less predictive of kindergarten DIBELS measures than previously demonstrated in extant literature. In addition, differences on literacy variables based on PLS were only found on one preschool measure and were not found on any kindergarten measure. Finally, no evidence for predictive bias was found based on PLS. This investigation reinforces the need for further attention and development in the area of literacy assessment for specific groups of young children.

Chapter I: Statement of the Problem

School and societal success, from childhood to adolescence and adulthood, are largely dependent on the development and acquisition of early literacy and conventional reading (Adams, 1990; Beswick & Sloat, 2006; Cunningham & Stanovich, 1997; Snow, Burns & Griffin, 1998; Snow, Porche, Tabors, & Harris, 2007). However, national reading performance is of substantial concern. Reading assessment results indicate that only one-third of fourth grade students test at or above proficiency, with another third failing to read even at a basic level, showing no overall gains between 2007 and 2009 (Lee, Grigg, & Donahue, 2007; National Center for Education Statistics [NCES], 2009). These data are particularly salient when considering research that demonstrates the distinct challenge of improving reading trajectories and outcomes. Stanovich (1986), for example, referred to "the Matthew effect." In essence, good readers have greater exposure to literacy experiences, supporting subsequent performance in the area of reading, as poor readers experience lower levels of literacy exposure, also connecting to future, comparatively low level performance (Stanovich). Specific to vocabulary, there is an approximate 2,000 root-word-meaning acquisition difference between students considered to be in the average range and those in the lowest quartile by the end of second grade (Biemiller, 2006). In a longitudinal context, Juel (1988) demonstrated that children considered poor readers in first grade were likely to continue to read poorly in fourth grade.

Further, the gap between good and poor readers is particularly concerning when performance of specific, traditionally underserved groups of children (i.e., culturally and linguistically diverse and/or those from low-income families) are considered. A more detailed examination of reading performance reflects a discrepancy between predominately white and/or non-poor student groups and groups of students who are ethnic-minority, low-income, and/or have limited English proficiency. To illustrate, as compared to the overall one-third of fourth graders who test at or above proficiency, only 18% of Hispanic students, 14% of Black students, and 7% of English Language Learners (ELLs) test at that level (Lee, et al., 2007). Further, regardless of student ethnicity or language status, poverty (i.e., as indicated by access to free or reduced school meals) remains a significant contributor in terms of reading achievement levels. That is, only 16% of fourth grade students eligible for free or reduced lunch programs achieved proficient reading levels, as compared to 45% of students who were not eligible (Lee, et al.).

Similar patterns illustrating both the overall concern for reading achievement as well as the performance gap between Caucasian, non-poor students and students who are ethnic-minority, from low-income families, and/or have limited English proficiency were present in groups of children as young as kindergarten and first grade. That is, many of these children have been shown to be at higher risk of starting school below their non-poor, predominately Caucasian peers on important indicators of later academic success. For instance, it was estimated that only 48% of students were able to read words in context by the end of first grade (Denton & West, 2002). Further, group differences were evident showing a greater proportion of students demonstrating word-reading in context in schools of higher socio-economic status (SES; 52%) as compared to students in schools of lower SES (27%) (Denton & West).

Investigation of literacy skills found to be precursors to conventional reading (i.e., letter recognition, beginning sounds, letter-sound relationships) also revealed a gap between children in poor and non-poor schools as early as kindergarten entry. That is, approximately two-thirds of students demonstrated letter recognition (46% in poor schools *vs*. 72% in non-poor schools), about one-third of students showed awareness and recognition of beginning sounds in words (13% in poor schools *vs*. 35%, in non-poor schools), and approximately one-fifth demonstrated ability to identify letter-sound relationships of ending sounds (6% in poor schools *vs.* 20% in non-poor schools) (Denton & West). In sum, not only is the problem of inadequate literacy acquisition in the United States severe, but it is also persistent, detectable in young children, and differentially problematic for specific groups of children in certain settings.

It has been suggested that the majority of reading problems can be prevented (Snow, et al., 1998). Through efforts to improve long-term reading outcomes for children, a vast amount of research has focused on the examination of precursors to conventional reading. In an early example of such research, Snow and colleagues (1998) offered a variety of predictors detectable at kindergarten entry that could be targeted in programs for prevention of risk in reading. These included language proficiency, verbal memory, lexical and syntactic skills, and phonological awareness. More specific investigations have examined predictors of early literacy skills exhibited by students in kindergarten and first grade as they relate to conventional reading outcomes. For instance, letter naming, letter sound knowledge, naming speed, vocabulary, measures of phonological awareness (i.e., phoneme segmentation and detection, rhyme, alliteration), as well as end of year kindergarten word reading have been related to varying levels of subsequently assessed conventional reading ability in early and late elementary school (Bryant, MacLean, Bradley, & Crossland, 1990; O'Connor & Jenkins, 1999; Schatschneider, Fletcher, Francis, Carlson & Foorman, 2004; Spira, Bracken, Fischel, 2005; Wagner, et al., 1997; Wagner, Torgesen, & Rashotte, 1994). However, growth in literacy skills during kindergarten may not be indicative of subsequent reading growth, performance, or meaningful improvement; as it may instead be due to students beginning the year with very low starting points on those literacy skills (Al Otaiba, et al., 2011).

Additionally, response to the state of literacy in the United States has been demonstrated through prevention efforts and federally funded programs. For instance, the development of conventional literacy (e.g., Reading First), early literacy and language (e.g., Early Reading First), and public-access preschool (e.g., Head Start or other federal- or state-funded preschool) programming has been critical to enhancing early language and literacy education for young children, and potentially shrinking the achievement "gap" between groups of low-income children and their non-poor, predominately Caucasian peers. Indeed, access to quality early education experiences has been an important component in the effort to prevent later academic deficits (Dickinson, McCabe, & Essex, 2006).

In general, however, programming and interventions aimed to impact literacy development for young children has shown mixed outcomes. For example, promising results from a 2007 U.S. Department of Education Reading First report showed increases in the percentages of students in first through third grades who met proficient levels in reading fluency (United States Department of Education, 2007). However, no statistically significant changes were observed on reading comprehension scores upon subsequent analyses (United States Department of Education, 2008). Addressing the literacy performance of younger children, outcomes from Early Reading First indicated that improvements were found on tasks related to print and letter knowledge, but not on those of phonological awareness or oral language (United States Department of Education, 2007). The Head Start Impact Study (United States Department of Health and Human Services, 2010) found multiple pre-academic, vocabulary, and literacy-related advantages associated with attending Head Start programming; however, many positive effects seemed to diminish by the end of first grade. Mixed results of these programs suggest that further examination of programming and assessment procedures that examine literacy during early periods of childhood, particularly those for children who are at increased risk for low literacy performance, are warranted. Further, an understanding of the early links to literacy development is crucial to conceptualizing various issues related to literacy acquisition and prevention of reading failure, including identification of necessary emergent skills, early identification of potential deficits in those skills, and valid assessment of those skills that can predict subsequent performance.

Emergent Literacy

Creating a thorough understanding of the process of literacy acquisition, research has examined the presence and development of literacy in children prior to kindergarten, or formal school entry. Models of *emergent literacy* have been conceptualized to frame an understanding of these initial skills. In an early review of emergent literacy, Whitehurst and Lonigan (1998) identified literacy components as either being *outside-in* processes or *inside-out* processes. *Outside-in* processes involve contextual understanding in literacy with some examples being language, conventions of print and emergent reading (pretending to read). *Inside-out* processes involve the rules required to translate writing into sound and some examples include grapheme knowledge, phonological and syntactic awareness, phoneme-grapheme correspondence, and emergent writing (pretending to write). Additional literacy components that have been studied include phonological memory, rapid naming (of letter or object), and interest or motivation in reading print (Whitehurst & Lonigan). Since then, Lonigan (2006) has identified three major components of emergent literacy skills as oral language, phonological processing, and print knowledge. Overall, emergent literacy has been described as the skills, knowledge, and attitudes that children exhibit prior to acquisition of conventional literacy (Teale & Sulzby, 1986; Whitehurst & Lonigan). Such skills and attitudes are interrelated and are fostered in young children by both home and classroom environments (Dickinson & McCabe, 2001).

Acknowledgement and adoption of *emergent literacy* as a framework for reading development, as opposed to an all-or-none, “reading-readiness” phenomenon, recognizes the development of literacy as an ongoing process, present and measureable early in childhood. In an effort to identify instructional and parenting practices as well as interventions that support literacy development in young children, the National Early Literacy Panel (NELP; 2009) conducted a research synthesis. Within that synthesis, research that reported results regarding examination of the role of pre-conventional literacy skills as predictors of conventional literacy skills (i.e., decoding, comprehension, and spelling) was summarized. Constructs including alphabet knowledge, phonological awareness, rapid automatic naming of letters, digits, and objects, letter- and name-writing, and phonological memory showed medium to large predictive relationships with subsequent literacy skills. These relationships held even when controlling for cognitive level and socioeconomic status (NELP). The synthesis also revealed a set of skills that showed moderate relationships with subsequent literacy but were less consistent. These included concepts about print and print knowledge, reading readiness, oral language, and visual processing. Moderate to high correlations between those skills and later decoding pertinent to the current investigation included phonological awareness (average r = .40 across 69 studies, n = 8,443), oral language (average r = .33 across 63 studies, n = 9,358) and rapid automatic naming of objects/colors (average r = .32 across 16 studies, n = 3,100) (NELP).

Of concern, results of the NELP (2009) report were somewhat limited with regard to reporting the predictive nature and strength of emergent literacy constructs for specific subgroups of children (Lonigan & Shanahan, 2010). Although the NELP discovered valuable information related to the early precursors of conventional literacy, an overall lack of data and primary research directly addressing questions related to emergent literacy skills of specific subgroups of children, such as Dual Language Learners, resulted in the NELP's inability to directly provide information regarding the literacy acquisition for those groups of preschool and kindergarten children (Shanahan & Lonigan, 2010).

Dual Language Learners (DLLs), also referred to throughout the literature as English Language Learners (ELLs), bilingual learners, or children with Limited English Proficiency (LEP), represent a diverse group of individuals who are learning at least two languages at once, or (in an English-dominant culture) those who are developing English in addition to their original language (U.S. Department of Health and Human Services, 2008). As even native English speakers continue to develop and *learn* their primary language as young children, those who are learning a second as they continue to develop their first (e.g., home and school languages) can be considered DLLs (Gutiérrez, Zepeda, & Castro, 2010). In short, these children are learning both languages, not *only* English.

This group is complex and represents wide variation in terms of linguistic abilities in both first (L1) and second (L2) languages. Initial exposure to a second language, for instance, may occur in the home simultaneously to the exposure of the first or primary language, or may begin only with the introduction of the child to center-based or school environments. Further, children considered DLLs have individual variation in the levels of exposure to L1 and L2 across contexts. Differences in exposure in these environments (e.g., home/family, community, center-based care or school) may relate to language acquisition and maintenance as well as possible literacy skills (Tabors & Snow, 2002). The construct and definition of DLL in relation to language acquisition is further complicated by preliminary evidence that caregiver report of language use in the home environment may not be accurate (Pressimone, 2011).

Of note, an estimated twenty percent of children have an immigrant parent, and a majority of those children (72%) speak a language other than English at home (Capps, Fix, Murray, Ost, Passel, & Hernandez, 2005). It is also estimated that 21% of school aged children and adolescents between 5- and 17- years-old (Aud, Hussar, Kena, Bianco, Frohlich, Kemp, et al., 2011) and 30% of children who attend Head Start (U.S. Department of Health and Human Services, 2008) come from families who speak a language other than English at home. In the face of severe need, there is an overall lack of information specific to the emergent literacy skills and constructs of Dual Language Learners as compared to the amount of research available related to emergent literacy in monolingual, English speaking preschoolers. Inadequacy of information in this area can be illustrated through the NELP (2009). Despite the fact that researchers included culturally and linguistically diverse groups of children in their investigations, they did not consistently report specific outcomes for those groups. In most cases, data were insufficient for metanalytic procedures to be conducted on specific subgroups; thus, definitive conclusions could not be drawn. Overall, and likely because of this, differences in child learning were seldom found based on demographic variables such as race, ethnicity, or SES (NELP, 2009; Shanahan & Lonigan).

In sum, evidence of connections between emergent literacy and later decoding and conventional literacy skills supports further examination of the predictive nature of specific emergent literacy skills and measures. In particular, skills present and measureable prior to formal school entry are in need of further evaluation, as there is still question as to which of those skills are most valuable in literacy prediction (Schatsneider, et al., 2004). That is the case even with the valuable addition of the NELP (2009) synthesis. Considering the increased focus on emergent literacy development in conjunction with the increased national pressures for educational accountability through assessment (e.g., No Child Left Behind, [NCLB], 2001), focus must be placed on the development of reliable measurement. Screening emergent literacy skills prior to the early elementary grades may aid practitioners in the early identification of students who require increased support at a young age, and the prevention of reading difficulties later in elementary school. This is particularly important for the assessment of young children who are at higher risk of failure in the area of literacy (i.e., children from low-income families, ethnic-minority children, and/or Dual Language Learners).

Measurement

Critical to the reliable and efficient identification of students who may be at risk for challenges in literacy development and subsequent reading difficulties is the issue of assessment. At a national level, increased emphasis on educational accountability and academic achievement has brought the subject of assessment to the forefront for those responsible for educating school-aged children. By extension, and related to the need for early identification and prevention of those academic difficulties, reliable and valid assessment tools for young children (i.e., children prior to school entry) are necessary. With regard to reading and its theoretical precursors, establishing evidence that currently available emergent literacy assessment tools are reliable and valid as predictors of success based on links to later literacy assessments is vital to the continued research in the area of literacy development at both theoretical and practical levels.

One way in which literacy skills have been measured has been through general outcome measures (GOM; Fuchs & Deno, 1991; Hojnoski & Missall, 2006; McConnell, 2000). GOMs are designed to assess progress toward long-term goals as opposed to specific subskill mastery assessments which are criterion-referenced and hierarchical by nature. Furthermore, GOMs are characteristically standardized, focusing on broad and prescriptive assessment of final tasks.

Two specific measures used by practitioners in order to assess performance in the area of literacy are the *Dynamic Indicators of Basic Early Literacy Skills (6th edition)* (*DIBELS*; Good & Kaminski, 2002) for students from preschool through third grade and the literacy *Individual Growth and Development Indicators* (*IGDIs*; Early Childhood Research Institute on Measuring Growth and Development, 2000; ECRI-MGD) for children preschool-age and younger (Hojnoski & Missall, 2006). DIBELS (*6th edition,* 2002) is a benchmark assessment that utilizes Oral Reading Fluency (in first through third grades) and early literacy indicators (i.e.: phonological awareness, print knowledge and decoding through Initial Sound Fluency (ISF), Letter Naming Fluency (LNF), Phoneme Segmentation (PSF), Nonsense Word Fluency (NWF)) as a general outcome measure to examine literacy performance and development from preschool through early elementary school. Most DIBELS (*6th Edition*, 2002) tasks administered during kindergarten (i.e., ISF, PSF, NWF) were developed largely based on results of a research synthesis that suggested phonological awareness and letter-sound association as specific precursors of reading (Good & Kaminski, 2002; National Reading Panel, 2000). Although LNF is included in assessment of kindergarten literacy knowledge, Good and Kaminski (2002) note that orthographic naming is not included in the National Reading Panel's (2000) research findings as a precursor to conventional literacy. DIBELS, overall, can be used as a part of screening, progress monitoring, diagnosis and measuring student outcomes (Coyne & Harn, 2006).

In its most recent edition, DIBELS NEXT (Good & Kaminski, 2011) was developed with the intention of improvement while maintaining the overall function of the measure (Good, Kaminski, Dewey, Wallin, Powell-Smith, Latimer, 2011). Content and presentation modifications were made to forms and passages, and student scores combine to create a composite score as the overall indicator for each student. Although the basic structure and skills assessed were maintained through the transition to DIBELS NEXT, replacements and additions of specific assessments were made. For instance, First Sound Fluency (FSF) replaced Initial Sound Fluency in assessing phonological awareness through the middle of kindergarten. In assessing third through sixth grade students, retell and errors are counted in scoring Oral Reading Fluency, and a maze task reading comprehension measure is included in the overall composite score. Further, various other administration and form modifications were made in an effort to increase ease and consistency of administration (Good, et al.).

Emphasizing the importance of dynamic and ongoing measurement, IGDIs were developed through an effort to enhance the link between assessment tools used in observing early functioning and tools used in assessing later skills or domains (ECRI-MGD Technical Report No. 1, 1998). Preschool IGDIs are part of a series of linked assessments connecting measures and outcomes from birth to grade school (Carta et al., 2002; Greenwood, Carta, & McConnell, 2011; McConnell et al., 2002). Primarily intended and designed for teachers and parents to monitor student growth, IGDIs are indicators of a child's place in development across broad domains that can also be used for screening and identification purposes (McConnell, Priest, Davis, & McEvoy, 2002). These broad developmental areas include communication, adaptive, social/emotional, cognitive, and motor domains (ECRI-MGD, 1998b).

Researchers have used specific components of IGDI assessments to address the cognitive domain. As the cognitive domain addresses the conceptual and practical understanding of early academic skills, this specific set of IGDIs comprise measures including *Picture Naming* (PN), *Rhyming* (RH) and *Alliteration* (AL). These have been utilized in order to capture emergent literacy skills of young children (e.g., Gettinger & Stoiber, 2008; Missall, McConnell &

Cadigan, 2006; Phaneuf & Silberglitt, 2003; VanDerHeyden, Snyder, Broussard, & Ramsdell, 2008). According to Missal, Reschly, Betts, McConnell, Heistad, Pickart, and colleagues (2007), with these emergent skill assessments being, at the time, the only tools of their kind to specifically address monitoring literacy for children ages three- to five-years. According to Greenwood and colleagues (2011), more than 10,000 schools have used the IGDIs to assess the literacy skills of over 150,000 children. Additionally, these emergent literacy measures have been used to support program evaluation. For instance, the 2007 U.S. Department of Education's National Evaluation of Early Reading First reports that 22% of teachers use the picture naming, rhyming and alliteration tasks in evaluation of their programs (U.S. Department of Education, 2007). Overall, PN, RH, and AL IGDIs have shown adequate psychometric properties for groups of typically developing children, children from low-income families who attend Head Start (Missall & McConnell, 2004), and children who are Dual Language Learners (Estrem & McConnell, 2008). In its most current edition, Individual Growth and Development Indicators of Early Literacy (IGDIs-EL, 2nd Edition; myIGDIs Early Literacy+; McConnell, Bradfield, Wackerle-Hollman, & Rodriguez, 2013) is a redesigned set of measures addressing oral language, phonological awareness, alphabet knowledge, and comprehension. In the new edition, the original three tasks (PN, RH, and AL) were redesigned and two additional tasks were included (Sound Identification – alphabet knowledge and Which One Doesn't Belong - comprehension).

Importantly, IGDIs are purported to be similar to DIBELS with differences primarily lying in the specific tasks required during administration and ages of children assessed (Get it, Got it, Go!, n.d.; myIGDIs.com, 2013). As such, they are considered a *downward extension*. However, limited data exist directly supporting this continuity between measures. For example, psychometric properties of IGDI measures report concurrent correlations with DIBELS Letter Naming Fluency and Onset Recognition Fluency (i.e., similar to the current Initial Sound Fluency), yet research is minimal in demonstrating the predictive relation between the IGDIs and kindergarten DIBELS measures. Specifically, only one research outside of technical reports and peer-reviewed presentations has examined the predictive validity of the IGDIs on DIBELS (or measures comparable). The first investigated the predictive nature of the IGDIs on district-developed, DIBELS-like measures (i.e., Missall, Reschly, Betts, McConnell, Heistad, Pickart, et al., 2007). Overall, results demonstrated low to moderate correlations between preschool and kindergarten IGDIs with kindergarten and first grade DIBELS-like measures of early literacy and paragraph reading. Models hypothesizing preschool emergent literacy latent variables (based on fall, winter, and spring PN, RH, and AL IGDIs) to predict a beginning of kindergarten latent variable (based on kindergarten fall RH and AL IGDIs plus Letter Naming and Letter Sound fluencies) showed large percentages of variance accounted for, but only moderate fit as predictive models based on fit indices.

The second study examined the predictive validity of the IGDIs (PN, RH, and AL) administered at pre-kindergarten registration on DIBELS assessed at three points during the kindergarten year (Leichman & Shapiro, 2009). This study also demonstrated low to moderate, statistically significant correlations among measures, with few (2 of 27) statistically non-significant results. Three separate multivariate multiple linear regressions were employed to further determine predictive validity, with all three overall models yielding statistically significant relations. However, when the predictive nature of individual IGDIs were examined, only PN and AL showed statistically significant predictive relations with most DIBELS measures while RH IGDI was only predictive (weakly) of two DIBELS measures. Finally, logistic regression was conducted using IGDI measures as continuous predictors and kindergarten DIBELS measures as dichotomous outcomes based on DIBELS-recommended benchmarks shown to predict subsequent success (or risk) on subsequent reading scores. Overall, all predictors had weak but statistically significant relations with all dichotomous outcome variables, except for spring Phoneme Segmentation Fluency (i.e., prediction to spring PSF statistically non-significant).

The two previously described studies are two of the only investigations that sought to demonstrate the predictive validity of the IGDIs on DIBELS (or DIBELS-like) measures. Of note, neither study focused solely on a sample of young children from low-income families, or specifically on a Head Start population. Specifically, although Missall and colleagues' (2007) participants were drawn from a predominately urban, low-income area, the final sample included 58% of students eligible for free or reduced price lunches. Further, exploration of the potential role of primary language (i.e., Dual Language Learners *vs.* English Only speakers) was not addressed in either study. One sample contained only 13% of students with limited English proficiency (i.e., Missall, et al., 2007), and results specific to those students were not discussed. The sample from the second study did not include demographic information regarding primary language (Leichman et al., in preparation).

Considering the importance of linking measurement and schooling experiences between the preschool and early period of formal schooling (Magnuson & Shager, 2010; Missall et al., 2007), it is critical to demonstrate these connections through research. Although purported links offer the intention of creating associations between assessments (i.e., *IGDIs* and *DIBELS*), actual accounts of these connections are minimal. Further, investigation of these connections is particularly important for young children at greater risk of literacy acquisition difficulties (i.e., children from low-income families and Dual Language Learners).

Purpose of Investigation

The purpose of the investigation was to examine the predictive validity of the *Individual Growth and Development Indicators* on the kindergarten measures of the *Dynamic Indicators of Basic Early Literacy Skills (6th edition)* in a group of children who attended Head Start, some of whom with a home language other than English. Establishing empirical support for the theoretical link between these measures was greatly needed given the current emphases on assessment and accountability in emergent literacy programming. This was particularly critical in the case of specific subgroups of children (i.e., children from low-income families, and Dual Language Learners) who, as a whole, showed greater need for programming and assessment in the area of prevention and prediction of risk for subsequent reading failure. Ability to reliably and accurately predict literacy performance using a tool administered prior to kindergarten would play an integral part in instructional and intervention decision making, both on individual and system-wide levels. Additionally, further support of the IGDI, a simple, easily administered measure, may promote more widespread emergent literacy screening.

Specifically, the following research questions were proposed:

RQ1: In a sample of children who attend Head Start, what is the predictive validity of the IGDI scores obtained in the spring of preschool on subsequent DIBELS scores collected during kindergarten?

a. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in fall of kindergarten (i.e., ISF and LNF)?

b. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in mid-year of kindergarten (i.e., ISF, LNF, PSF, and NWF)?

c. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in spring of kindergarten (i.e., LNF, PSF, and NWF)?

d. For that sample, what are the relations among IGDIs (spring of preschool PN, RH, AL) and change scores between derived from winter and spring of kindergarten DIBELS scores (i.e., LNF, PSF, NWF)?

H1: Based on results from Missall and colleagues (2007), it was hypothesized that low to moderate, statistically significant correlations would be found among IGDI and DIBELS measures at all points across kindergarten. Based on the work of Leichman and Shapiro (2009), omnibus multivariate models for three kindergarten time points would also be significant; however, RH IGDI scores would show weaker and possibly non-significant connections to the DIBELS measures than PN and AL IGDI scores. This was also supported by the NELP (2009) finding that rhyming is one of the least predictive skills of later literacy.

RQ2. In a sample of children who attend Head Start, are group differences based on parent-reported primary language status at preschool entry (i.e., Primary Language English (PLE) vs. Primary Language Other (PLO) evident in literacy scores (i.e., preschool PN, RH, and AL IGDIs and kindergarten DIBELS) at each test administration point?

H2. Technical Report research on Dual Language Learners and IGDI performance (Estrem & McConnell, 2008) suggested that primary home language affects mean levels on all three IGDI scores, with primary English speakers scoring higher than Dual Language Learners. Thus, it was hypothesized that primary English speakers would have higher IGDI scores at end of preschool than Dual Language Learners. Further, based on DLL vs. non-DLL group differences found on DIBELS-like kindergarten literacy measures with non-DLL students outperforming others (Betts, Reschly, Pickart, Heistad, Sheran, & Marston, 2008), it was hypothesized that students reported as having a primary language of English, overall, would yield higher mean scores than the DLL group on kindergarten DIBELS measures.

RQ3. In a sample of children who attend Head Start, does parent-reported primary language status at preschool entry (i.e., Primary Language English (PLE) vs. Primary Language Other (PLO)) affect, or moderate, the predictive relations between IGDIs and DIBELS tests?

a. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten fall DIBELS (i.e., ISF and LNF) moderated by parent-reported language status (i.e., PLE *or* PLO)?

b. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten mid-year DIBELS (i.e., ISF, LNF, PSF, and NWF) moderated by parent-reported language status (i.e., PLE *or* PLO)?

c. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten spring DIBELS (i.e., LNF, PSF, and NWF) moderated by parent-reported language status (i.e., PLE *or* PLO)?

H3. As the participants were expected to differ in primary language exposure and use (i.e., preschool entry, parent-reported Primary Language English (PLE) vs. Primary Language Other (PLO)), and test administration was conducted in an English-only context, it was expected that the preschool IGDIs would differentially function as a predictor of subsequent kindergarten literacy skills for each language status group.

Chapter II: Review of the Literature

United States fourth grade reading outcomes show that approximately one-third of students cannot read at a basic level. This deficit is significant in its sheer number and persistent in its impact on student ability to reach adolescent (Snow et al., 2007) and civic (Beswick & Sloat, 2006; Snow, et al., 1998) milestones. Reading difficulty is prevalent and persistent. However, identification of early skills (i.e., emergent literacy skills) that are predictive of later literacy development is critical to the process of identifying students who may be at risk for subsequent literacy failure, as early identification can lead to prevention of that failure.

Potentially more alarming than the overall level of reading performance is that children from low-income families who have fewer resources readily accessible are at even greater risk for experiencing reading failure, and children from ethnic-minority and/or English language learning backgrounds are disproportionately represented in that group (Dickinson & McCabe, 2001; Douglas-Hall & Chau, 2008). This is the case not only for children in later elementary school (NCES, 2009), but also for children in first grade, at kindergarten entry (Denton & West, 2002), and prior to formal school entry (i.e., preschool children) (Brattle, 2009; Dickinson & McCabe, 2001). Unfortunately, research consistently demonstrates that, overall, children from low-income families enter school with literacy and language skills that are less well-developed than those of their higher-income peers, and relationships between emergent literacy skills and later reading remain strong, as those children demonstrate relatively lower performance through school (Arnold & Doctoroff, 2003; Magnuson & Shager, 2010; Magnuson & Waldfogel, 2005). Thus, it is critical to identify, measure, and monitor skills known to be indicative of literacy acquisition very early in every child’s life. Further, considering the variable level of readiness for learning as early as the preschool level (i.e., ages three to five), development of measures that reliably identify children who may be at risk for later reading difficulties is particularly important.

Early indicators of literacy acquisition: Emergent literacy

The process of literacy acquisition is considered developmental and continuous when conceptualized through an emergent literacy model (Whitehurst & Lonigan, 1998). Emergent literacy reflects the interrelated skills, knowledge, and attitudes related to literacy activities present before conventional literacy (Teal & Sulzby, 1986; Whitehurst & Longigan; Dickinson & McCabe, 2001). Several domains have been identified, including phonological awareness, oral language, rapid naming of orthographic and non-orthographic images, print and alphabet knowledge, concepts about print, and emergent writing (NELP, 2009). In order to determine critical aspects of emergent literacy that are predictive of reading development, research reviews and meta-analysis have been conducted. For example, through meta-analytic procedures, the NELP (2009) found phonological awareness and memory, rapid naming of letters, objects, and/or colors, alphabet knowledge, oral language and early name writing as being moderate to strong predictors of later decoding and early formal literacy skills (e.g., reading comprehension). Through a separate literature review, Lonigan (2006) recognized oral language, phonological processing skills, and print knowledge as the most consistent predictors of subsequent reading acquisition. Efforts to identify early skills as indicators of development are critical to understanding the overall process of literacy acquisition, and possibly identifying young children at risk for reading failure. As such, a large body of research has examined the predictive strength and nature of specific skills through longitudinal designs.

Development and prediction. Several studies have examined longitudinal relations between emergent literacy skills as assessed as early as preschool and kindergarten with later literacy skills (i.e., later emergent literacy skills, early formal literacy skills, and/or conventional reading skills). For example, in one longitudinal investigation, 540 kindergarten students from predominately middle-class families were assessed across multiple emergent literacy constructs in order to determine the predictive utility of those constructs on subsequent reading achievement (*n* = 384 in first grade, *n* = 189 in second grade) (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Multiple emergent literacy constructs were assessed as predictors including phonological awareness (seven tasks including onset-rime and phoneme level skills yielding a single score), print/letter knowledge, oral language, rapid naming (of letters and objects), matching and copying geometric forms. These assessments were administered at three points across the kindergarten year. Word recognition, comprehension, and fluency were assessed at the ends of first and second grades. In sum, phonological awareness, knowledge of letter sounds, and rapid naming of letters were the most consistent unique predictors of reading-related outcomes in first and second grades. One limitation of the study was that conventional literacy assessment did not extend past second grade, where the impact of vocabulary may have become stronger in terms of its relation to reading comprehension.

In a study examining skills in preschool children, Lonigan and colleagues (2000) assessed two groups of preschool aged children primarily from middle- to upper-class communities, one averaging 41.02 months and the other averaging 60.04 months of age at initial assessment. Each group was assessed twice (i.e., one from early to late preschool, and the other from late preschool to kindergarten or first grade) examining phonological sensitivity, oral language and cognitive ability, letter and letter-sound knowledge, environmental print and print concepts as well as word decoding. In the older group, it was found that preschool oral language, letter knowledge, and phonological awareness were correlated with decoding skills assessed 1 year later; however, only oral language and letter knowledge added unique variance to the decoding prediction. Additionally, results from a structural equation model supported the notion of stable development of early emergent literacy skills, as the latent variable representing phonological sensitivity at age 6 was predicted perfectly by that latent variable at age 5. However, phonological sensitivity was less stable from early preschool to late preschool, with a zero-order correlation of only .14 between Time 1 and Time 2 (18 months later) of the younger sample. Importantly, early measures only accounted for 17% to 25% of the variance in late preschool phonological sensitivity, supporting the need for further investigation of the precursors and measurement of early and emergent literacy development.

In another longitudinal study following over 600 children from preschool through fourth grade, Storch and Whitehurst (2002) administered an extensive battery of assessments examining code-related, oral language and reading skills in the spring of Head Start (preschool) and kindergarten through fourth grade years, totaling six assessment periods. It was found that both oral language (e.g., expressive and receptive vocabulary, story recall) and code-related skills (e.g., print concepts and phonological awareness) in pre-kindergarten were predictive of kindergarten early literacy skills as well as subsequent reading ability. Specifically, preschool code-related skills accounted for 38% of the variance in kindergarten code-related skills, which in turn accounted for approximately 58% of variance in a student's first grade reading ability and approximately 30% of variance in second grade reading ability. Oral language ability appeared consistent over time with preschool oral language ability accounting for 90% of variance in kindergarten, kindergarten ability accounting for 96% of variance in first and second grades, and first and second grades accounting for 88% of variance in third and fourth grades. In terms of the concurrent relationship between these skills, preschool oral language skills (e.g., receptive and expressive vocabulary, narrative recall) accounted for 48% of variance of preschool code-related skills (e.g., letter naming, word and sentence segmentation) but only 10% of variance in kindergarten, suggesting a potential separation of skills over time. Moreover, early code-related skills were found to primarily associate with early reading (decoding), while early oral language primarily associated with later reading comprehension. Results showing the emergence of strong associations between early oral language ability and subsequent elementary school reading comprehension relate to the notion that after third grade, children need at least an average vocabulary in addition to decoding and word recognition skills for successful comprehension (Biemiller, 2006).

Together, these studies support the notion that skills related to conventional reading are indeed detectable in early childhood. This is the case for children from upper- and middle-class environments, as well as for children who attend Head Start (i.e., children primarily from low-income families). Longitudinal connections support the importance of obtaining information about a child's phonological awareness and code-related skills, as well as information about a child's oral language and vocabulary at an early age. However, two overarching study limitations are apparent. First, studies based conclusions on data obtained from literacy measures both with and without previous psychometric validation. In addition, overall, demographic and environmental factors that may have contributed to results were not included in evaluation.

These limitations, particularly related to inadequate attention to potential mediating or moderating factors, are not uncommon to the overall literature base examining emergent literacy. For example, through a document review of the NELP report as well as interviews and a focus group roundtable session with multiple experts in the area of emergent literacy, gaps in the current literature base were addressed (Abdullah-Welsh, Flaherty, & Bosma, 2009).

Recommendations linked to the identified gaps were formulated in order to create a research agenda. Among those need-based research recommendations were suggestions regarding assessment development and attention to at-risk student groups. Specifically, it was recommended that attention be placed on the development of assessment tools that measure emergent literacy and language in young children. Within that general recommendation, there was a clear call for the creation and validation of those tools specifically for English Language Learners. Further, the report recognized a clear lack of research that presented outcomes and analyses of data by subgroups of children (e.g., based on socioeconomic, primary language, or ethnic minority status). For instance, Roseth, Missall, and McConnell (2012) made a strong contribution to the current literature on use of IGDIs with young children by demonstrating when PN, RH, and AL are sensitive to growth in young children (i.e., 3- and 4-year-olds) and developing age-based norms; however, this sample included only "typically developing" children, excluding children living in poverty, those who spoke a language other than English as their primary language, and those who had or were suspected of having a disability.

Select factors affecting emergent literacy. Certainly, there is a strong literature base supporting the predictive nature of emergent literacy skills as assessed in pre-kindergarten and kindergarten. To develop a deeper understanding of the nature of these skills, however, it is also valuable to identify factors that affect the development of these emergent literacy skills. Educators and researchers can then be aware of specific groups of children who are at elevated risk for emergent literacy and reading difficulty. Indeed, multiple child-level variables, in addition to environmental factors, have been identified as indicators and predictors of emergent literacy development, as multiple indicators of emergent literacy skills have been demonstrated as predictors of subsequent conventional literacy.

For instance, in a study conducted by McDowell, Lonigan, and Goldstein (2007), various predictors of phonological awareness were assessed. Seven hundred preschool aged children ranging in age from 2- to 5-years-old were assessed across a variety of measures assessing speech-sound accuracy and vocabulary. Socioeconomic status (SES) was coded based on the preschool funding source. Although data were cross-sectional in nature, it was determined that child socioeconomic status, age, speech sound accuracy, and vocabulary each uniquely contribute to the prediction of phonological awareness. In addition, age moderated the associations between speech sound accuracy and phonological awareness. That is, the association between poor speech-sound accuracy and poor phonological awareness is stronger for older children. Age also moderated the relationship between SES and phonological awareness, indicating that for older children, the positive relation between SES and phonological awareness becomes stronger. This suggests a widening gap across SES groups as children age, with children from higher SES backgrounds outperforming those from lower SES backgrounds.

Another study examining contributing factors to the development of phonological awareness followed 52 children from kindergarten through second grade (Cooper, Roth, Speece, & Schatschneider, 2002). Multiple child- and family-level background variables were assessed and included in a regression model to determine unique prediction of kindergarten oral language and phonological awareness. Background variables, including IQ, family literacy, socioeconomic status, and child primary language predicted oral language scores in kindergarten, but not phonological awareness scores. Further, oral language in kindergarten provided unique contributions to phonological awareness in kindergarten through second grade. This was the case regardless of reading ability, with authors suggesting oral language (as well as other related factors tested) as predictors of reading abilities through influence on phonological awareness. A significant limitation of the study was the small sample size and narrow assessment of phonological awareness (two phoneme-level tasks).

Identifying factors (e.g., SES, language abilities) that directly or indirectly contribute to differential performance on emergent literacy tasks is helpful in identifying specific subgroups of children who require that closer attention be paid to their emergent literacy skill development. One specific subgroup of children that is at greater risk for challenges to literacy skill development, and thus, requires enhanced attention and support is a group that consists of children who speak a primary home language other than English.

Dual Language Learners, language, and emergent literacy. Dual Language Learners (DLLs), also referred to throughout the literature as English Language Learners (ELLs), bilingual learners, or children with Limited English Proficiency (LEP), are individuals who are learning at least two languages at once, or those who are developing English in addition to their original language (U.S. Department of Health and Human Services, 2008). As even native English speakers continue to develop and *learn* their primary language as young children, those who are learning a second as they continue to develop their first (e.g., home and school languages) can be considered DLLs (Gutiérrez, Zepeda, & Castro, 2010). In short, these children are learning both languages, not *only* English. Of note, an estimated twenty percent of children have an immigrant parent, and a majority of those children (72%) speak a language other than English at home (Capps, Fix, Murray, Ost, Passel, & Hernandez, 2005). It is also estimated that 21% of school aged children and adolescents between 5- and 17- years-old (Aud, Hussar, Kena, Bianco, Frohlich, Kemp, et al., 2011) and 30% of children who attend Head Start (U.S. Department of Health and Human Services, 2008) come from families who speak a language other than English at home.

Language. In conjunction with specific emergent literacy constructs, it is critical to understand potential language acquisition processes of children learning more than one language, as well as some of the contextual variables that may influence that acquisition. For instance, aspects of home language environment, in monolingual and bilingual families, influence language acquisition and production (Hart & Risley, 1995; Tabors & Snow, 2002). Language exposure, for example, in terms of quantity and quality of language a child is exposed to in the home (Hart & Risley, 1995) as well as language input patterns of caregivers (De Houwer, 2007) can affect the language acquisition of young children. Further, levels and types of first (L1) and second (L2) language exposure may vary across contexts (e.g., home, center-base care, preschool/school, community), and abilities of children to acquire and maintain expressive and receptive skills in both L1 and L2 vary depending amounts and types of language exposure across those environments (Tabors & Snow, 2002). For instance, home environments may be monolingual (English or non-English) or bilingual with variation in the degrees, or patterns, of L1 and L2 exposure. Center-based, classroom, and community environments can also differ regarding language exposure, and affects the maintenance, development, and use of both languages (Tabors & Snow; Hammer, Scarpino, & Davison, 2011).

Regarding oral language, children whose first experience with English is outside of the home (i.e., those who come from a non-English, monolingual home environment and attend English preschool or school setting) develop English in a cumulative, developmental sequence (Tabors & Snow, 2002). Initially, children speak their home language in attempts to communicate, with young children requiring time to understand that the language in the novel setting is distinct from their home language. Children then progress from a non-verbal period to using telegraphic (e.g., naming, counting, reciting alphabet) and formulaic (e.g., brief phrases and words that initiate and terminate social situations) language. Finally, children begin to demonstrate productive use of the novel language, creating their own phrases (Tabors & Snow). Related to vocabulary development and oral language, children exposed to bilingual environments (home and/or school) have been demonstrated to have lower expressive vocabularies than those of their monolingual peers (Hammer, Scarpino, & Davison, 2011; Páez, Tabors, & López, 2007); however, bilingual and monolingual children's cumulative vocabularies may be quantitatively similar (Hammer, et al., 2011).

Emergent literacy. Despite the prevalence of young students who require services based at least partially on primary language status, definitive information regarding the literacy development, literacy-focused interventions, and predictive nature of emergent literacy skills for Dual Language Learners is minimal as compared to the information available based on monolingual children (Gutiérrez, et. al, 2010). As mentioned, critiques of the NELP (2009; Gutiérrez, et al., 2010) assert that inadequate analyses of sociodemographic factors (e.g., primary language status) limited the results and conclusions made by the NELP. Lonigan and Shanahan (2010) noted that, indeed, few studies considered in the meta-analysis had adequate information regarding sociodemographic variables as they related to emergent literacy outcomes.

As another example of a review revealing inadequate attention to emergent literacy and DLLs, results of a descriptive and meta-analytic review of intervention studies that involved caregivers and supported emergent literacy development for young children (Manz, Hughes, Barnabas, Bracaliello, & Ginsburg-Block, 2010) provide an illustration of neglect to specific sociodemographic effects on emergent literacy issues. It was found that only half of studies included critical demographic information (e.g., ethnicity and native language) pertinent to address the question for *whom* interventions functioned. In other studies, researchers either removed participants from specific subgroups, or failed to conduct any subgroup analyses, thereby ignoring the potential effects of those groups. Specific to emergent literacy and language learners, results based on primary language status was not able to be obtained because there were not enough studies included that identified and targeted a sufficient number of Dual Language Learners (Manz et al.). Further, an additional review of the research gaps as well as interviews with experts in the field resulted in specific recommendations for further research related to emergent literacy and DLLs (Aud et al., 2011).

Emerging research does show, however, that the function of emergent literacy constructs (e.g., phonological awareness, code-related skills) exhibited in a child's primary language (with most studies assessing Spanish-speaking children), may be similar to the function of those skills for children who only speak English. For instance, Branum-Martin, Mehta, Fletcher, Carlson, Ortiz, Carlo, and colleagues (2006) found that blending nonwords, segmenting words, and phoneme elision predicted both within- and between-language word reading. Further, significant overlap in kindergarten (*n*=812) Spanish and English abilities in emergent literacy constructs such as phonological awareness were evident (Branum-Martin, et al., 2006). Branum-Martin and colleagues also found significant within-language relations among those constructs. One limitation of this study was that Spanish measures were researcher derived, without previous evidence of psychometric adequacy.

Additional research found that, when controlling for phonological awareness, skills important in the prediction of English literacy were different from those considered important in the prediction of Spanish literacy for bilingual children in early elementary school. Through examination of the phonological processing and oral language skills of 249 Spanish-speaking English language learners, Lindsey, Manis, and Bailey (2003) demonstrated that (when controlling for phonological awareness) kindergarten print knowledge and phonological access most consistently predicted first grade English reading skills, and vocabulary, phonological access, and phonological memory predicted Spanish reading. Overall, some cross-linguistic transfer was supported among literacy and language variables, as demonstrated by correlations among those variables (Lindsey et al.).

In general, much of the research examining the predictive utility of literacy constructs and measurement tools for Dual Language Learners has focused on skills in kindergarten and early elementary school (e.g., Branum-Martin, Mehta, Fletcher, Carlson, Ortiz, Carlo, et al., 2006; Linklater, O'Connor, & Palardy, 2009; Yesil-Dagli, 2011), and limited information exists for preschool children. However, an emerging literature base exists addressing the literacy constructs and skills of preschool-aged bilingual children, albeit complex and mixed in terms of its results. One study, for example, showed similar results to those presented by Branum-Martin and colleagues (2006) in that cross-language transfer of key emergent literacy constructs were found in a study examining phonological awareness of DLLs (Spanish and English speakers) for 123 preschool children who attended Head Start (Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004). In this study, children were assessed in fall and spring of the preschool year. Tasks requiring rhyme recognition and initial or final phoneme deletion detection were administered in fall and spring of preschool in both English and Spanish, and were considered part of a phonological awareness construct. Letter identification, emergent writing, and print knowledge, and environmental print reading were also assessed at the two time points, but only assessed in the primary language and considered to represent an emergent literacy construct. Finally, receptive language was assessed in the spring only, but in both languages.

Results indicated low to moderate correlations between receptive vocabulary and all other variables, moderate correlations between emergent literacy variables and other test variables. Finally, phonological awareness variables showed moderate to high correlations with all other phonological awareness variables, low to moderate correlations with receptive vocabulary. Of note, the strongest associations were among phonological awareness skills assessed in different languages at the same time point, possibly suggesting cross-language transfer of phonological awareness. The strength of this cross-language transfer did not hold, however, from fall to spring. A significant limitation of this investigation was that although children were identified as being primarily English or Spanish speakers within their DLL identity, results were not separated for the two groups. Thus, although a distinction was made related to primary language, results could not be drawn based on that distinction.

Although Lindsey and colleagues (2003), Dickinson and colleagues (2004), and Branum-Martin and others (2006) found some support for cross-language transfer of phonological awareness skills (a core emergent literacy component), other researchers have determined that although cross-language transfer may be evident, stronger associations are found within language. For example, in a study examining 158 Dual Language Learners (i.e., Spanish as home language) who attended Head Start, Anthony, Solari, Williams, Schoger, and Zhang (2009) administered assessments of phonological awareness, letter name and sound knowledge, and vocabulary at time one, and assessments of phonological awareness at time two (approximately four months later). All assessments were administered in both English and Spanish. Both cross-language and within-language associations were determined, but within-language associations were stronger.

Similarly, Spanish and English emergent literacy screeners administered to a group of DLLs (*n* = 267) at the beginning of the preschool Head Start year accurately predicted emergent literacy skills (oral language, print, and phonological processing) assessed in both languages at the end of the preschool year (Farver, Nakamoto, & Lonigan, 2007). Results demonstrated stronger within-language predictions than across-language predictions. A strong implication of this research is that pre-established primary language emergent literacy skills (e.g., phonological awareness) can be considered an asset, as there is some evidence for cross-language overlap. However, further clarification regarding the emergent literacy skills of preschool DLLs, including the role of appropriate measurement tools, is needed.

Assessment – Emergent Literacy in Early Childhood

Increased requirements related to educational accountability have resulted in a strong emphasis on appropriate processes for assessment, and within that, the development of reliable and valid measurement tools. Indeed, even in early childhood education environments, the emerging legislative requirements and overall call for tracking child performance is linked to the need for adequate assessment tools and methodology (Strickland, 2005). Of note, as of 2005, 43 states had preschool standards in language, literacy and mathematics with the remaining states working toward final development of those standards (Neuman & Roskos, 2005). A review of state government websites indicated that the remaining seven states developed such standards as of 2013. Further, all but one state-funded early learning initiative meets the quality standards benchmark of having early learning standards incorporated into overall state-funded preschool programming (Barnett, Carolan, Fitzgerald, & Squires, 2012). Intending to maximize benefits and prevent harm through assessment procedures with young children (National Research Council, 2008; NRC), multiple organizations (e.g., National Education Goals Panel, NEGP;

National Association for the Education of Young Children, NAEYC; Division of Early Childhood, DEC) have posed guidelines for assessment selection and methodology when working with young children. Recommendations common across many of those organizations as summarized by the NRC (2008) include that assessments should (a) benefit children, (b) meet professional, ethical, and legal standards, (c) be psychometrically sound and for specific purpose, (d) be appropriate for the individual child, (e) be available for caregiver involvement, (f), be culturally and linguistically appropriate, (g), assess relevant content (i.e., for development and/or education), (h), obtain information from familiar and realistic environments, (i), be from multiple sources, (j), be used to improve learning and instruction, (k), be linked to follow-up assessments. Development of such recommendations not only reflects the comprehensive efforts placed on the improvement of assessment components, but also suggests that procedures in practice may not completely adhere to such guidelines. Thus, additional research and development in early childhood assessment is certainly warranted.

In general, guidelines for common goals in early childhood assessment have been important to the process of measurement development and tracking a child's place within specific domains. The areas of language and emergent literacy, of critical importance, are included as one of the National Education Goals Panel (NEGP; 1995) recommended domains for evaluation in the development of young children. Moreover, research reviews and policy recommendations have consistently supported further development or adaptation of measurement tools that reliably and validly assess literacy development for children overall (National Research Council, 2008; NRC; Strickland, 2005) as well as for specific subgroups of children, such as Dual Language Learners (Garcia & Miller, 2008; Gutiérrez, et al., 2010;

McCardle, Mele-McCarthy, & Leos, 2005) and children who are from low-income families (Magnuson & Hager, 2010).

For instance, the NRC (2008) notes that screening tools should have sound psychometric properties, including strong predictive validity. Further, to address the school readiness gap based on race, ethnicity, and socioeconomic status, Magnuson and Shager (2010) recommended policy- and practice-related strategies that include *enhancing continuity* between preschool and formal schooling by linking preschool experiences (e.g., curriculum, assessment) to later schooling and classroom experiences. Enhancing the capabilities of early childhood settings to address the needs of English Language Learners was also recommended (Magnuson & Shager, 2010). Taken together, there has been a clear and coherent call for the continued development of measurement tools, supporting the need to link assessments from preschool experiences to formal schooling. Linking assessments and skills across time and settings may be particularly important for groups of children who, overall, show performance on critical skills at school entry (Magnuson & Waldfogel, 2005).

Given the increased emphasis on emergent and pre-literacy development, specifically stability of skills between late preschool and kindergarten (Lonigan et al., 2000; NELP, 2006), focus must be placed on continuity of assessment across age groups. Evidence of these connections supports further examination of the predictive validity of specific emergent literacy measures. In fact, the Forum on Early Literacy Screening to Promote School Success (National Center for Learning Disabilities, 2005) promotes the alignment of assessments across grades as well as the shift from intensive high school level assessments to a steady, continuous monitoring of individual and school achievement across school years. Screening of emergent literacy skills conducted prior to the early elementary grades may aid practitioners in the early identification of students requiring increased support at a younger age and potentially preventing reading difficulties in elementary school.

One literacy measure used by practitioners and researchers to assess performance in the areas of both early and conventional literacy is the *Dynamic Indicators of Basic Early Literacy Skills* (*6th Edition*; Good & Kaminski, 2002). The *DIBELS* (*6th Edition*) as well as its most recent revision, *DIBELS NEXT* (Good & Kaminski, 2011), are benchmark assessments that utilize Oral Reading Fluency (ORF; in first through third grades) and measures of various early literacy skills (in kindergarten) as general outcome measures of literacy. Both DIBELS *6th Edition* and DIBELS NEXT have the same basic structure and purpose, assessing phonological awareness, print knowledge, and decoding; however, modifications were made to forms, passages, font on student forms, assessor instructions. Additionally, the kindergarten early literacy measure of *Initial Sound Fluency* (ISF) was replaced with *First Sound Fluency* (FSF; Good, et al., 2011). Preliminary data indicated that correlations between ISF and FSF were moderate, ranging from .57 and .62 (n > 1,000) when assessed concurrently at the beginning and middle of kindergarten, respectively. A moderate correlation (r = .46) was determined when beginning of kindergarten FSF was compared to middle of kindergarten ISF (Cummings, Kaminski, Good, & O'Neil, 2011). Generally, the DIBELS measures are extensively administered across the United States (Missall et al., 2007) and can be used as a part of screening and identification of student need, progress monitoring, evaluating effectiveness of intervention, diagnosis and measuring student outcomes (Coyne & Harn, 2006; Good, Gruba, & Kaminski, 2002).

To monitor emergent literacy in preschool aged students, researchers and practitioners have utilized specific tools within the Individual Growth and Development Indicators (IGDIs; Early Childhood Research Institute on Measuring Growth and Development, 1998; 2000).

Preschool IGDIs are part of a series of linked assessments connecting measures and outcomes from birth to grade school (Carta et al., 2002; Greenwood, et al., 2011; McConnell et al., 2002). Primarily intended and designed for teachers and parents to monitor student growth, IGDIs are indicators of a child's place in development across broad domains that can also be used for screening and identification purposes (McConnell, Priest, Davis, & McEvoy, 2002). More specifically, researchers have used components of the IGDI under the cognitive domain including Picture Naming (PN), Rhyming (RH) and Alliteration (AL) in order to capture emergent literacy skills of young children (e.g., Gettinger & Stoiber, 2008; Missall, McConnell & Cadigan, 2006; Phaneuf & Silberglitt, 2003; Roseth, et al., 2012; VanDerHeyden, Snyder, Broussard, & Ramsdell, 2008). Roseth and colleagues (2012) developed age-based norms and demonstrated sensitivity to growth using PN, RH, and AL that was differential based on age (i.e., 3-year-olds vs. 4-year-olds) in a large sample (*N* = 7355) of typically-developing children (i.e., only children who were primary English-speaking, not living in poverty, did not have known or suspected cognitive disability). Further, Estrem and McConnell (2008) demonstrated the validity of PN's use to measure skill growth for young preschool-aged children from low-income families who are learning English as a second language. Sensitivity to growth on RH and AL with those children was determined valid when children were 48-months or older. EL-IGDI is purported to measure oral language through rapid automatic naming of pictures and phonological awareness through the rhyme and alliteration metrics (ECRI-MGD, 2000). As mentioned, these two overall constructs have been identified as showing some of the strongest predictive relations to later formal literacy acquisition (NELP, 2009; Lonigan, 2006).

Two studies examined the concurrent validity and test-retest reliability (Wilson & Lonigan, 2009) and diagnostic accuracy (Wilson & Lonigan, 2010) of two emergent literacy assessments, the *Revised Get Ready to Read* (GRTR-R; Whitehurst & Lonigan, 2001) and the *IGDI*s on an established, diagnostic emergent literacy criterion measure (i.e., Test of Preschool Early Literacy (TOPEL; Lonigan, Wagner, Torgesen, & Rashotte, 2007). All measures were administered at both time points (just prior to preschool and three months later). For analyses, *IGDI* PN, a sum of RH and AL termed *phonological awareness* (PA), and a total score (PN, RH, AL together) were utilized. Criterion measure early literacy index total score as well as subtest scores (i.e., print knowledge, definitional vocabulary, and phonological awareness) were interpreted. The first wave of testing occurred immediately prior to preschool entry, and the second wave occurred three months later to 176 preschool children with mean age 48.49 months, primarily Caucasian. The majority of preschools and child care centers that children attended did not provide literacy-related curricula. Socioeconomic and primary language status was not reported.

Results of Wilson and Lonigan (2010) showed moderate test-retest reliability over the three months ranging between 0.38 and 0.48 for IGDI PN, PA, and total scores (in ascending order of magnitude). Concurrent validity coefficients (i.e., correlations) between predictor (i.e., GRTR and IGDI) and criterion (i.e., TOPEL) were also analyzed. In relation to the overall outcome index score and print knowledge subscore, the GRTR outperformed the IGDI (strong vs. moderate or low associations, respectively); however, validity of GRTR-R and IGDI scores were more often similar when measuring the association with vocabulary and phonological awareness as subscores (moderate vs. moderate or low associations). Specific to IGDI measures, validity coefficients were statistically significant and ranged from 0.18 and 0.46 at time one, and 0.15 and 0.55 at time two. In most cases, use of the IGDI total score resulted in the strongest associations among measures (Wilson & Lonigan, 2010).

In assessing diagnostic accuracy, Wilson and Lonigan (2009) determined IGDI and GRTR-R cut scores (maintaining a sensitivity level of at least 0.90, allowing specificity to vary) when predicting TOPEL scores as assessed at time two (three months after initial assessment). In order to create the cut scores and subsequent diagnostic accuracy statistics (e.g., predictive power, sensitivity, specificity) outcome scores were dichotomized using the 25th percentile to determine which students were "at-risk" and which were not. As in the Wilson and Lonigan (2010) study, IGDI PN, PA (i.e., RH, AL), and total (i.e., RH, AL, PN) were used for analysis. Similar to their previous findings, the GRTR-R outperformed the IGDIs in terms of diagnostic accuracy when using performance on the full early literacy index score as the target outcome. Overall results showed that the GRTR-R was a better screening instrument in terms of accurate classification than the IGDIs when utilizing the TOPEL as an outcome measure. In terms of outcome measure subscores, IGDIs and GRTR-R showed more accurate predictions to print knowledge than vocabulary and phonological awareness. In all cases, because measurement sensitivity (ability to detect students at risk on the outcome measure) was the focus and set at least to 0.90 when cutscores were selected, specificity and negative predictive power (reflecting ability to accurately detect children not at-risk) were generally weak.

Through a separate line of research, two IGDI measures (RH and PN) were utilized within a more comprehensive kindergarten screening measure. In order to examine bias in prediction based on status as a DLL and ethnicity, Betts, Reschly, Pickart, Heistad, Sheran, and Marston (2008) tested the predictive validity of literacy measures assessed at the end of kindergarten on a conventional reading measure administered at the end of second grade. Specifically, the universal kindergarten literacy assessment administered to students in Minneapolis public schools incorporates IGDI AL and RH (but not PN) within the battery of skills tested. Phoneme segmentation, letter name and sound identification, and passage reading were also assessed. The universal kindergarten testing was administered at the end of kindergarten, and conventional literacy assessed through a standardized reading measure was given at the end of second grade. Students were classified by primary language status (i.e., DLLs and non-DLLs) as well as by ethnicity (i.e., European American, African American, Asian American, and Asian American). Results indicated that the kindergarten battery had a strong overall predictive relationship with the second grade reading test. Although no predictive bias (i.e., extent to which differential prediction existed based on demographic factors) was found based on DLL vs. non-DLL status, some initial intercept differences were found between European American and Hispanic American students (i.e., group differences based on ethnicity, not English proficiency status). Overall, non-DLLs outperformed DLLs, and European American students outperformed ethnic minority students on kindergarten and second grading literacy tests. One limitation was that DLL status encompassed multiple languages. Indeed, it is possible that predictive bias may have been determined if languages were delineated. Further, results could have varied if literacy measures were administered in fall of kindergarten, as English instruction and experience with fluency probes over the course of the school year likely modified DLL students' English literacy experiences and performance.

Although these investigations offer valuable information about the predictive performance of the IGDIs on a subsequently assessed preschool diagnostic literacy measure (Wilson & Lonigan, 2009; 2010) and a second grade conventional reading assessment (Betts et al., 2008), none of the studies examined the ability of the IGDIs to connect performance of children in preschool to their performance on literacy measures in kindergarten. Only one investigation examined the potential effect of Dual Language Learners on the predictive relations among measures, offering important information about the IGDIs as used with second language learners at the end of kindergarten. However, results related to IGDIs through the Betts and colleagues (2008) study should be tempered, as IGDIs were incorporated as parts of a more comprehensive assessment tool assessed at the end of kindergarten. Indeed, further assessment of predictive utility of the IGDIs is warranted, particularly over the preschool to kindergarten transition period.

Critical to the development and purpose of the PN, RH, and AL *IGDIs* as general outcome measures on an important domain, they are purported to be similar to the DIBELS showing differences in specific skills assessed and age of children tested (Get it, Got it, Go!, n.d.). Thus, IGDIs can be considered a downward extension of the DIBELS in that intent of measurement developers was to link measurement tools for children from birth to age eight (Carta et al., 2002; McConnell et al., 2002). However, there is limited empirical support for this connection. Specifically, only two studies examined the predictive relations of the IGDIs on the DIBELS (or district-developed, DIBELS-like measures).

First, in a longitudinal study following a group of students from preschool through first grade, Missall, Reschly, Betts, McConnell, Heistad, Pickart, and colleagues (2007) examined the predictive validity of the literacy skills of 143 preschoolers. Children were originally recruited from preschools that surrounded high need elementary schools, but only slightly more than half of the sample qualified for free or reduced lunch price. IGDIs were administered in the fall, winter and spring of preschool as well as in the fall and spring of kindergarten. During the kindergarten year, DIBELS-like district assessments of Letter Sound Knowledge were administered in the fall, winter and spring, Letter Naming in fall and spring, Onset Phoneme

Identification in the winter, and Phoneme Segmentation in the spring. Passage Reading was administered in spring of kindergarten and first grade.

Correlations examining the predictive validity of the preschool measures were low to moderate (*r* = .19 to .61) with only a few (6 out of 81) being statistically non-significant. An early literacy latent variable representing the EL-IGDIs at spring of preschool accounted for 97% of the variance in the beginning of kindergarten latent variable. Importantly, though, it should be taken into account that IGDI measures in addition to other early literacy fluency measures (i.e., letter-sound knowledge) contributed to the latent variable at the beginning of kindergarten. That is, some of the predictive ability of the IGDIs in this case was accounted for by subsequent IGDI scores, not only subsequent scores on district developed DIBELS-like measures. One finding with great practical implication was that fall preschool Picture Naming (PN) correctly categorized 72.7% of readers at spring of first grade as being "masters" (reading at least 60 words correct per minute) or "non-masters" (reading fewer than 60 words correct per minute). Creating early measurement tools with strong predictive utility to subsequent literacy tools that are based on benchmarks, and thus, identifying students who are at risk for reading difficulties, is critical to the ability of educators to provide further assessment and intervention services to the students who need extra intervention and support.

In a second study, researchers assessed the predictive validity of the *IGDIs* (PN, RH, and AL) administered at pre-kindergarten registration specifically on *DIBELS* given at three points during the kindergarten year (Leichman & Shapiro, 2009). This study also demonstrated low to moderate, statistically significant correlations among measures, with few (2 of 27) statistically non-significant results. In addition, three separate multivariate multiple linear regressions were employed to further determine predictive validity, with all three overall models yielding statistically significant relations. However, when the predictive nature of individual *IGDIs* were examined, only *PN* and *AL* showed statistically significant predictive relations with most *DIBELS* measures while *RH IGDI* was only predictive (weakly) of two DIBELS measures. Finally, logistic regression was conducted using *IGDI* measures as continuous predictors and kindergarten DIBELS measures as dichotomous outcomes based on DIBELS-recommended benchmarks shown to predict subsequent success (or risk) on subsequent reading scores. Overall, all predictors had weak but statistically significant relations with all dichotomous outcome variables, except for spring Phoneme Segmentation Fluency (i.e., prediction to spring PSF statistically non-significant).

As students were assessed at public school kindergarten registration, whether or not the students had previous preschool experience was unknown. Additionally, participant sociodemographic variables (e.g., income indicator, primary language, ethnicity) were not reported. It is possible for any of these factors to have affected study results. Because this is the single study of IGDIs as predictive of the DIBELS, and one of the only studies of the predictive validity of the IGDIs overall, further investigation establishing the predictive validity of the IGDIs specifically on the DIBELS is warranted.

In the current investigation, determining the predictive validity of the IGDIs on subsequently administered DIBELS is proposed. IGDIs were administered in the spring of the preschool year, and DIBELS were administered in the subsequent kindergarten year, thus, addressing the need to link assessment tools across the preschool-to-kindergarten transition period. Children attended a Head Start program prior to kindergarten entry, and attended a single school district for the kindergarten year. Living in an urban community of the Eastern United states, many of the children were identified has having a primary home language other than English.

Although research consistently relates emergent literacy skills to later literacy (NELP, 2009), only two studies (i.e., Missall, et al., 2007; Leichman & Shapiro, 2009) specifically demonstrate the relation between IGDIs and DIBELS (or DIBELS-like) measurement tools. Despite predictive relations demonstrated by those studies, further research is clearly necessary for (a) general replication, (b) validation of the tool on a specific subgroup of students (i.e., young children from a low-income, urban area who attended Head Start), and (c) testing the predictive utility of the IGDIs for children with a primary home language other than English (Dual Language Learners). As development across domains is variable and rapid in young children, and administration of assessments can be challenging considering inexperience in test-taking, management of technical adequacy of assessment in early childhood can be difficult (Greenwood, Luze, & Carta, 2002). Despite the challenges, it is crucial to gain an understanding of the validity of any measure, particularly when it may be utilized for any educational decision-making for the child.

Indeed, this study will meet several gaps in the current literature. First, and primarily, results of this study would add to the current research specific to the theoretical connection between *IGDI* and *DIBELS (6th Edition)* by demonstrating the actual connection between the two specific measures through a predictive framework. In addition, it addresses the general recommendation of the National Institute for Literacy to continue to develop and validate literacy assessments for young children (Abdullah-Welsh, Flaherty, & Bosma, 2009). Second, the connection will be demonstrated through a longitudinal framework across the preschool-to-kindergarten period based on the performance of young children who attended Head Start.

Studying the predictive validity of a measurement tool within this subgroup of children (i.e., children from primarily low-income families who attended center-based early education setting) directly addresses the established need for further emergent literacy research with groups of children who are at higher risk of entering kindergarten with lower literacy performance. Third, the research question addressing primary language status (i.e., if the student is considered a DLL or not) as a potential moderator of the relations between emergent literacy skills as assessed by the IGDIs and DIBELS addresses the need for research on emergent literacy skills and assessment tools for Dual Language Learners (Abdulla-Welsh, et al., 2009).

Chapter III: Method

Participants and Setting

The participants for the current investigation included a subset of children originally assessed as part of an evaluation of a U.S. Department of Education Early Reading First (ERF) grant. ERF's primary mission is to support children with language, cognitive, and early reading skills prior to kindergarten entry (U.S. Department of Education, n.d.). All children in the original evaluation (i.e., 3- and 4-year olds) attended one of seven Head Start preschool classrooms, located across three sites in an urban area of Eastern Pennsylvania. Head Start preschool classrooms primarily serve students (at least 90%) whose families are at or below the poverty level (Community Services for Children, 2007). All children in the current investigation participated in Head Start classrooms that employed a literacy-focused curriculum delivered in English, as supported by the ERF funding. Prior to kindergarten entry, child exposure to the ERF-funded programming ranged from seven months to two years. Evaluation of the programming occurred over a three year period, resulting in three cohorts of children.

Subgroups of 4-year-old children from the three cohorts (i.e., Cohorts 1, 2, and 3) who entered a single school district in Eastern Pennsylvania were followed from Head Start preschool classes through kindergarten. Those subgroups combined to comprise the total sample (n = 94) analyzed in this investigation. All students attended the Head Start preschool program in the school year immediately prior to the kindergarten year (i.e., 2005-2006, 2006-2007, and 2007-2008, respectively). Students from Cohort 1 (n=25, 48% of 4-year-olds from full cohort) attended kindergarten in the 2006-2007 school year, those from Cohort 2 (n=34, 81% of 4-year-olds from full cohort) attended kindergarten in the 2007-2008 year, and those from Cohort 3 (n=35, 65% of 4-year olds from full cohort) attended kindergarten in the 2008 – 2009 school year. The Eastern Pennsylvania school district attended by the participants served approximately 18,000 students from preschool through twelfth grade and reported 12.6% English Language Learners (NCES, n.d.) and 75.3% of students received reduced price lunch (PDE, n.d).

Child demographic information including age at kindergarten entry and primary language status is presented in Table 1. Primary language status was determined through parent report at preschool program entry using the Home Language Survey. Overall, slightly less than two-thirds of the sample was reported speak English primarily (60.6%), and the remainder of the group was reported to speak a language other than English (i.e., Spanish or other) primarily. Students were an average of 65 months-of-age at kindergarten entry, and gender showed almost equal representation (i.e., 49 males and 45 females). Literacy measures administered in the spring of preschool (i.e., *IGDI*) and at three points throughout kindergarten (i.e., *DIBELS*) were examined.

Measures: EL-IGDI

Picture Naming. During this test of rapid automatic naming designed to assess expressive language, the examiner presented the child with pictures (photos or drawings) of objects found in the natural environment. Four standard sample cards were presented as training items at which point the examiner modeled the words then instructed the child to name those sample cards. If the child was able to name those cards, he or she was then told to name as many pictures as quickly as possible. The child was prompted to give a response if he or she did not do so within 3 seconds. If an additional 2 seconds passed without response, the examiner moved to the next stimulus card. The child's score was the number of pictures correctly named in 1-minute.

Picture Naming showed one month alternate-form reliability coefficients ranging from $r = .44$ to $.78$ (McConnell et al., 2002) and test-retest reliability with a sample of 29 preschoolers over 3 weeks was $r = .67$ (Missall & McConnell, 2004). Additionally, significant correlations were found between age and PN score ($r = .41$ longitudinally where $n = 90$; $r = .60$ cross-sectionally where $n = 39$), suggesting sensitivity to expressive language growth (Missall & McConnell, 2004). Hierarchical Linear Modeling (HLM) analyses have resulted in an average PN score of 26.9 for typically developing children with a slope of .44 pictures per month, 19.0 for children living in poor economic settings with a slope of .28 pictures per month and 16.9 for children with disabilities with a slope of .36 pictures per month when age was centered at 66 months (Priest, McConnell, McEvoy, & Shinn, 2000 as cited in Missall & McConnell, 2004). An HLM analysis conducted in a subsequent study showed, with age centered at 59 months, an average PN score for children not identified to be at risk as 16.97, for children living in poor economic settings as 16.51, for children with speech and language disabilities as 14.13 and for Spanish-speaking English language learners as 2.64 (Missall et al., 2006).

In terms of concurrent validity, research has shown this measure to have a moderate to high correlation with the Peabody Picture Vocabulary Test – Third Edition (PPVT-3; Dunn & Dunn, 1997; $r = .56$ to $.75$) and the Preschool Language Scale - 3 (PLS - 3; Zimmerman, Steiner, & Pond, 1992; $r = .63$ to $.79$; Priest, McConnell, McEvoy & Shinn, 2002 as cited in Missall & McConnell, 2004). With regard to Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski & Good, 1996), Picture naming has been shown to have statistically significant but weak correlations with measures of Letter Naming Fluency (LNF; $r = .26$ to $.37$; Missall, 2002 as cited in Missall & McConnell, 2004) and Onset Recognition Fluency (OnRF; $r = .32$ to $.49$; Missall, 2002 as cited in Missall & McConnell, 2004). Cummings and colleagues (2011) found low and statistically non-significant correlations between beginning and end of year preschool PN with beginning, middle, and end of year DIBELS ISF and DIBELS NEXT FSF ($35<n<40$

across assessment points). Further, Missall and others. (2007) showed significant and low to moderate level correlations between preschool PN scores and spring of first grade curriculum based measurement (CBM; Fuchs & Deno, 1991) oral reading where r = .42 using preschool fall scores, r = .48 using preschool winter scores and r = .37 using preschool spring scores. Roseth and colleagues (2012) estimated a linear growth trajectory that resulted in .56 picture per month increase overall for typically developing children ranging in age from 36 to 60 months (*N* = 7355). Expected scores one standard deviation below and above the mean ranged from 6.35 pictures (expected growth rate .34 pictures per month) to 17.36 pictures (expected growth rate .78 pictures per month) for 36-month-old children. Linear-spline models were a better fit to data than linear models and indicated that 3-year-old preschoolers gained .47 pictures per month and 4-year-olds gained .59 pictures per month, resulting in a 25% growth rate increase from 3- to 4-year olds. Preliminary predicted age-based norms resulted in an average of 12.59 pictures at 36-months-old, 18.23 pictures at 48-months-old, and 25.31 pictures at 60-months-old.

Finally, Estrem and McConnell (2008) reported that children who spoke English as a primary language named 15.14 pictures per minute with HLM centered at 53.92 months (median age, *N* = 2306, students attending Head Start). Average performance was significantly greater than those with a primary home language of Spanish, Somali, Hmong, or “other,” and affected by age (i.e., language learners were older than primary English speakers when they began naming pictures in English). Growth on PN, however, was not different based on primary language status.

Rhyming. During the Rhyming IGDI (RH-IGDI; ECRI-MGD, 2000) administration, the child was presented with a series of cards each containing 4 pictures. Adapted from work by Lonigan and colleagues (1998), the picture on top represented the stimulus picture (e.g., bees) and the three pictures below represented 1 correct and 2 incorrect response pictures (e.g., pants, gate, cheese). The examiner pointed to and labeled each picture then asked the child to point to the picture on the bottom that "sounds the same as" the target picture on top. A set of samples were given with 2 cards completely modeled for the child and 4 additional cards for which the child was required to respond. If the child responded correctly to 2 of the 4 practice items, the task was administered with novel cards for 2 minutes. As in Picture Naming, the child was prompted to answer after 3 seconds of not responding, and a new card was presented after an additional 2 seconds without responding. The score was the number of correct responses within 2 minutes.

Using a sample of 42 preschoolers, test-retest reliability of RH-IGDI over three weeks was r = .83 to .89 (Missall & McConnell, 2004). Using HLM with age centered at 53 months, the average RH score was 7.61 with a slope of .38 rhymes per month for typically developing children, 6.5 with a slope of .95 rhymes per month for low income children, and 5.07 with a slope of .40 rhymes per month for children with disabilities (Priest, Silberglitt, Hall, & Estrem, 2000 as cited in Missall & McConnell, 2004). Also using HLM, Missall et al. (2006) found the average RH score to be 6.29 for typically developing children, 1.66 for children living in poor economic settings, 1.68 for children with identified speech and language disabilities, and .79 for Spanish-speaking English language learners when age centered at 59 months. Also showing some sensitivity to growth, a significant correlation was found with chronological age (r = .46; Priest, Silberglitt, Hall, & Estrem, 2000 as cited in Missall & McConnell, 2004).

RH-IGDI correlated with PPVT-3 (r = .56 to .62), Concepts About Print (CAP; Clay, 1985; r = .54 to .64), as well as the Test of Phonological Awareness (TOPA; Torgesen & Bryant, 1994; r = .44 to .62), showing correlations to other measures of early literacy development

(McConnell et al., 2002; Priest, et al., 2000). RH-IGDI correlated with Picture Naming (*r* = .54) as well as with Alliteration (*r* = .43; Priest, et al., 2000. Additionally, concurrent validity with DIBELS measures has been demonstrated including that with Letter Naming Fluency (LNF; *r* = .48 to .59) and Onset Recognition Fluency (ORF; *r* = .44 to .68; Missall, 2002 as cited in Missall & McConnell, 2004). Cummings and colleagues (2011) determined low and statistically non-significant correlations between beginning of year preschool RH with beginning, middle, and end of year DIBELS ISF and DIBELS NEXT FSF ($46 < n < 56$ across assessment points). Statistically non-significant correlations were also found between end of year preschool RH and beginning of preschool FSF, as well as beginning and middle of preschool ISF ($23 < n < 29$ across assessment points). However, end of year preschool RH showed moderate correlations with mid-year preschool FSF (*r* = .40, *n* = 26), end of year preschool FSF (*r* = .49, *n* = 25), and end of year preschool ISF (*r* = .49, *n* = 25), (Cummings, et al.). Further, Missall et al. (2007) showed low to moderate, statistically significant correlations between preschool RH scores and spring of first grade curriculum based measurement (CBM; Fuchs & Deno, 1991) oral reading where *r* = .37 using preschool fall scores, *r* = .41 using preschool winter scores and *r* = .51 using preschool spring scores. Roseth and colleagues (2012) estimated a linear growth trajectory that indicated that 36-month-old children can be expected to identify 0 rhymes correctly. Slope differences indicated that children performing one standard deviation (SD) above the mean can be expected to gain 0.59 rhymes per month while children performing one SD below the mean grow at 0.15 rhymes per month. Linear-spline models were a better fit to data than linear models and indicated that 3-year-old preschoolers gained .09 rhymes per month and 4-year-olds gained .56 rhymes per month, resulting in a 522% growth rate increase from 3- to 4- year olds.

Preliminary predicted age-based norms resulted in an average of 1.52 rhymes at 36-months-old, 2.60 rhymes at 48-months-old, and 9.32 rhymes at 60-months-old.

Finally, Estrem and McConnell (2008) reported that children who spoke English as a primary language named 0.53 rhymes per two minutes with age centered at 53.92 months (median age, n = 2306, students attending Head Start). Average rhyming score was significantly greater than those with a primary home language of Spanish, Somali, or Hmong, but not "other," and affected by age (i.e., language learners were older than primary English speakers when they began rhyming). Growth on RH was slower for primary English speakers than for children who spoke Somali or Hmong, but not for those who spoke Spanish.

Alliteration. During the Alliteration IGDI (AL-IGDI; ECRI-MGD, 2000) administration, the child was again presented with a series of cards each containing 4 pictures. The picture on top represented the stimulus picture (e.g., rake) and the three pictures below represented 1 correct and 2 incorrect response pictures (e.g., rain, house, pig). Also adapted from work by Lonigan and colleagues (1998), the examiner pointed to and labeled each picture then asked the child to point to the picture on the bottom that "begins with the same sound as" the target picture on top. Similar to the rhyming measure, a set of samples was given and if the child responded correctly to 2 of the 4 practice items the task was administered with novel cards for 2 minutes. Examiners used the same prompting procedure as described above for nonresponding. The score was the number of correct responses within 2 minutes.

For a sample of 42 preschoolers, test-retest reliability of AL-IGDI over three weeks was r = .46 to .80 (Missall & McConnell, 2004). In addition, AL-IGDI was found to correlate positively with age (r = .61; McConnell et al., 2002) suggesting sensitivity to growth over time. Using HLM with age centered at 53 months, the average AL score was 5.23 with a slope of .38

alliterations per month for typically developing children, 4.28 with a slope of .25 sounds per month for low income children, and 4.43 with a slope of .36 sounds per month for children with disabilities (Priest, Silberglitt, Hall, & Estrem, 2000 as cited in Missall & McConnell, 2004). Also using HLM, Missall and colleagues (2006) found the average AL score to be 5.19 for typically developing children, 1.09 for children living in poor economic settings, .94 for children with identified speech and language disabilities, and .71 for Spanish-speaking English language learners when age centered at 59 months. Estrem and McConnell (2008) reported that children who spoke English as a primary language named 0.31 pictures by onset per two minutes with HLM centered at 53.92 months (median age, $n = 2306$, students attending Head Start). Average alliteration score was significantly greater than those with a primary home language of Spanish, Somali, Hmong, and "other," and affected by age (i.e., language learners were older than primary English speakers when they began completing alliteration tasks). Growth on AL was slower for primary English speakers than for children who spoke Somali or Hmong, but not for those who spoke Spanish or "other." Of note, primary English speakers had a slower growth rate than primary Spanish speakers, but the difference was not statistically significant.

Longitudinal research examined criterion validity yielding the following results: PPVT-3 ($r = .40$ to .57), TOPA ($r = .75$ to .79), and CAP ($r = .34$ to .55; McConnell et al., 2002). Also, concurrent validity between this measure and DIBELS Letter Naming Fluency ($r = .39$ to .71; McConnell et al., 2002; Missall, 2002 as cited in Missall & McConnell, 2004) were moderate to high. Cummings and colleagues (2011) determined low and statistically non-significant correlations between beginning of year preschool AL with beginning, middle, and end of year DIBELS ISF and DIBELS NEXT FSF ($46 < n < 55$ across assessment points). Statistically non-significant correlations were also found between end of year preschool AL and beginning of preschool FSF, as well as beginning and middle of preschool ISF ($23 < n < 29$ across assessment points). However, end of year preschool AL showed moderate correlations with mid-year preschool FSF ($r = .54$, $n = 26$), end of year preschool FSF ($r = .62$, $n = 25$),, and end of year preschool ISF ($r = .80$, $n = 26$), (Cummings, et al.). Further, Missall and colleagues (2007) showed significant and low to moderate correlations between preschool AL scores and spring of first grade curriculum based measurement (CBM; Fuchs & Deno, 1991) oral reading where $r = .26$ using preschool fall scores, $r = .43$ using preschool winter scores and r = .50 using preschool spring scores. Finally, Roseth and colleagues (2012) estimated a linear growth trajectory that indicated that 36-month-old children overall can be expected to identify 0 beginning sounds correctly. However, children (36-months-old) scoring one SD above the mean can be expected to identify 2.14 beginning sounds. Slope differences indicated that children performing one standard deviation (SD) above the mean can be expected to gain 0.45 beginning sounds per month while children performing one SD below the mean grow at < 0.01 beginning sounds per month (using linear growth models). Linear-spline models were a better fit to data than linear models and indicated that 3-year-old preschoolers gained 0 beginning sounds per month and 4-year-olds gained .35 beginning sounds per month, resulting in a 1650% growth rate increase from 3- to 4- year olds. Preliminary predicted age-based norms resulted in an average of 1.42 beginning sounds at 36-months-old, 1.66 beginning sounds at 48-months-old, and 5.74 beginning sounds at 60-months-old.

Measures: DIBELS (6th Edition)

Initial Sound Fluency. To assess Initial Sound Fluency, students were shown a set of pictures, told the names of the pictures and asked to find the picture that begins with the matching sound. For example, the examiner says “This is mouse, flowers, pillows, letters. Which

one begins with the sounds /fl/?" For this investigation, the task was administered at fall and mid-year of kindergarten. By mid-year of kindergarten, the benchmark goal was for children to have 25-35 initial sounds correct, with students scoring less than 10 sounds correct potentially requiring additional instructional support in this area. Student response time was recorded and the score was the number of correct onsets per minute (Good & Kaminski, 2002).
Alternate form reliability collected at 5 points during one school year ranged from .51 to .73 with a median of .61 (Assessment Committee, 2002). In a separate study, one-month alternate form reliability was shown to be .72 in January of kindergarten (Good, Kaminski, Shinn, Bratten, Shinn, Laimon et al., 2004). In their sample of 86 students, Hintze, Stoner and Ryan (2003) found a reliability coefficient of .86.

Hintze and colleagues (2003) found that ISF correlated with the Phonological Awareness Composite (PACom) of the Comprehensive test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) at .60 and with the Phonological Memory Composite (PMCom) of the CTOPP at .46. In the winter of kindergarten, concurrent validity with DIBELS PSF was found to be .48 and .36 with the Woodcock Johnson Psycho-Educational Battery readiness cluster. In terms of predictive validity, ISF had a median correlation of r = .38 with curriculum based measurement of Oral Reading Fluency in the spring of first grade and r = .36 with the Woodcock-Johnson Psycho-Educational Battery total reading cluster standard score (Good et al., 2004).

Letter Naming Fluency. To assess Letter Naming Fluency, students were required to name as many letters as possible in 1-minute. This was administered at three points (fall, mid-year and spring) of kindergarten. At the end of kindergarten, students scoring 40 or more letters correct per minute were considered to be at low risk for reading difficulty. Alternate form reliability with sample size ranging from 71 to 215 participants using data collected at 7 points in time during one school year showed a median coefficient of .89 in kindergarten (Assessment Committee, 2002). Hintze and colleagues (2003) found alternate form reliability to be .94. Kindergarten LNF showed a median validity of .75 with the Woodcock-Johnson Psycho-Educational Battery-Revised readiness cluster standard score at the end of kindergarten. Tests of predictive validity showed correlations between kindergarten LNF and NWF in winter of first grade of .71, May of first grade CBM ORF of .71 (Good et al., 2004), and May of first grade Woodcock-Johnson Total Reading Cluster of .66 (Assessment Committee, 2002). Hintze and colleagues (2003) found that LNF correlated with the PACom of the CTOPP (Wagner, Torgesen, & Rashotte, 1999) at .53 and with the Phonological Memory Composite (PMCom) of the CTOPP at .52.

Phoneme Segmentation Fluency. Assessing Phoneme Segmentation Fluency required students to produce individual phonemes for three and four phoneme words and was assessed at mid-year and spring of kindergarten. For example, if the examiner said the word “sit” and the student responded by saying /s/ /i/ /t/, the student received three points. A student was considered to be established in PSF with a score of 35 or more at the end of kindergarten. The score was the number of correct sounds produced by the student.

One-month alternate form reliability in spring of kindergarten is .79 (Good et al., 2004). Another study using 86 participants found alternate form reliability to be .97 (Hintze et al., 2003). PSF concurrently correlates with the PACom of the CTOPP (Wagner, Torgesen, & Rashotte, 1999) at .53 and with the Phonological Memory Composite (PMCom) of the CTOPP at .39 (Hintze et al., 2003). Concurrent validity of kindergarten PSF with the spring of kindergarten Woodcock Johnson Psycho-Educational Battery readiness cluster was .56. Tests of predictive validity showed median correlations between kindergarten spring PSF with first grade winter NWF of .62, first grade spring Woodcock-Johnson Psycho-Educational Battery total reading cluster of .63 and first grade spring CBM ORF of .62 (Good et al., 2004). Other reports showed predictive correlations between kindergarten PSF and winter NWF ranging from .33 to .68, Woodcock Johnson Psycho-Educational Battery total reading cluster ranging from .38 to .68, and May of kindergarten NWF ranging from .37 to .49 (Assessment Committee, 2002).

Nonsense Word Fluency. During administration of Nonsense Word Fluency, which occurred at mid-year and spring of kindergarten, students were instructed to say the sounds of the letters in the pretend word or read the whole word given. Students received points for each correct sound produced within one minute. Students were considered to be at low risk for poor reading outcomes with a score of 25 or more at the end of kindergarten. The median, one-month alternate form reliability was shown to .83 in first grade (Good et al., 2004).

Correlations between first grade NWF and Woodcock-Johnson Psycho-Educational Battery-Revised readiness cluster yielded a median concurrent validity of .51 (Assessment Committee, 2002). NWF assessed at mid-year of first grade yielded a median predictive validity of .81 with curriculum based measurement of ORF measured in the spring of first grade, .68 with curriculum based measurement of ORF measured in the spring of second grade, and .66 with the Woodcock-Johnson Psycho-Educational Battery total reading cluster in May of second grade (Good et al., 2004).

Procedures

Caregiver consent was obtained prior to measurement administration. Through the larger evaluation study, measures assessing emergent literacy skills were administered for each student across preschool and kindergarten years. Training through professional development sessions was provided for Head Start teachers and teacher assistants to administer *IGDI*s (ECRI-MGD, 2000) to preschool students. As a component of the broader evaluation, administration occurred on an approximate monthly schedule through the end of each school year. Over the preschool year, assessment administration was observed by graduate students and university consultants in approximately 25% of cases to obtain inter-observer agreement (IOA) (i.e., to calculate total agreement). As the current investigation intended to address the predictive nature of emergent literacy skills as assessed by the *IGDIs* (ECRI-MGD, 2000) on Kindergarten *DIBELS* (*6^th^ Edition*; Good & Kaminski, 2002) at the preschool transition period, measures from spring of preschool (Preschool Spring assessment only) and across kindergarten (Fall, Winter, and Spring assessments) were the primary focus of the current investigation.

During kindergarten, school district personnel administered DIBELS measures (i.e., Initial Sound, Letter Naming, Phoneme Segmentation, and Nonsense Word Fluencies) at three periods across the school year. At the beginning of the kindergarten years (September), Cohort 1 was assessed with LNF and Cohorts 2 and 3 were assessed using LNF and ISF. At the mid-year (January), students in Cohort 1 were administered LNF, PSF, and NWF, while Cohorts 2 and 3 were administered LNF, PSF, NWF, and ISF. Finally, at the end of the kindergarten years (May), all Cohorts were administered LNF, PSF and NWF. Table 2 displays the assessment schedule. IOA was obtained through direct observation and audio recording of teacher and school personnel test administration behavior on a portion of LNF, PSF, and NWF testing. Although IOA was not targeted for all students in the current investigation, the students' kindergarten teachers were observed. Thus, IOA will be represented as an overall estimation of participants' teachers' abilities to reliably administer kindergarten early literacy measures.

Statistical Analysis

The following analyses were conducted to answer the current research questions. Specifically, the following research questions were proposed:

RQ1: In a sample of children who attend Head Start, what is the predictive validity of the IGDI scores obtained in the spring of preschool on subsequent DIBELS scores collected during kindergarten?

a. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in fall of kindergarten (i.e., ISF and LNF)?

b. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in mid-year of kindergarten (i.e., ISF, LNF, PSF, and NWF)?

c. For that sample, what is the predictive validity of the IGDIs (spring of preschool PN, RH, AL) on the DIBELS administered in spring of kindergarten (i.e., LNF, PSF, and NWF)?

d. For that sample, what are the relations among IGDIs (spring of preschool PN, RH, AL) and change scores between derived from winter and spring of kindergarten DIBELS scores (i.e., LNF, PSF, NWF)?

Analyses: In order to assess the predictive validity of the IGDIs on the DIBELS, Pearson Product Moment Correlations (*r*) were completed for the full group of children, as well as for the children considered DLLs, and those considered EO as separate groups. To further determine evidence of predictive validity of the IGDIs on the DIBELS measures, univariate and multivariate multiple linear regressions (MLR and MMLR, respectively) were conducted to address the questions of predictive validity of the IGDI variables (i.e., PN, RH, AL) on the DIBELS (6^{th} edition) at each time point at kindergarten. Since students in Cohort 1 were not assessed on ISF in fall or midyear, ISF were assessed through separate analyses on those two time points. Thus, the following analyses were conducted: two separate MLRs to address the prediction of fall ISF and LNF, one MLR to assess ISF and one MMLR to assess LNF, PSF, and NWF at midyear, and one MMLR to assess the prediction of LNF, PSF, and NWF. Three IGDI scores were entered simultaneously as a predictor set.

MLR was conducted in order to predict a single outcome using one or several predictor variables. MMLR was utilized to predict several dependent variables from a predictor set (Stevens, 2002). *Wilks' lambda* was obtained for each overall multivariate model, indicating the strength of the omnibus prediction model (i.e., 1 - *Wilks' lambda*). To assess the full set of predictors' influence on each individual dependent variable, R^2 was interpreted as the amount of variance in the dependent variable explained by the full set of predictors. Beta (β) values (weights) were found for each separate predictor-dependent variable pair, indicating the change in dependent variable for one standard unit change in predictor variable. Prior to conducting the MLR and MMLR, statistical assumptions were checked. First, it was noted that independence of observation had been met. Second, linear relationships (i.e., correlations) among predictor and dependent variables were demonstrated. Third, each dependent variable was examined for univariate normality (Stevens, 2002). To do so, skewness and kurtosis values (acceptable values as ($< |\pm\text{-}2.00|$)) were examined, and histograms of standardized residuals were inspected. Transformations proposed by Stevens (2002) were employed to address variables that showed severe variations from normality.

To demonstrate multivariate normality for multivariate analyses, bivariate normality was examined through visual inspection of scatterplots for all pairs of dependent variables, as elliptical shapes on scatterplots indicate bivariate normality (Stevens, 2002). Further, variables were tested to ensure multicolinnearity diagnostics outside of recommended values were not problematic (i.e., tolerance < 10 and variance-inflation factor > 0.2; Myers, 1990; Menard, 1995). A possible solution to multicollinearity included combining the variables into a single variable.

Power analyses for these analyses were conducted. For MLRs using three predictors, estimating a medium effect size, utilizing an alpha level of 0.05 seeking to detect a power level of 0.80, a minimum sample size of 76 is recommended (Cohen, 1992). For MMLR, analyses were conducted based on procedures outlined by Cohen (1988) using the same set of parameters ($f^2 = 0.15$, medium effect size). To meet those criteria, analyses suggested that a minimum sample size of 49 participants was necessary when three predictor and three outcome variables were analyzed (i.e., for midyear and spring analyses). Table 3 reflects sample sizes (participants with full data sets) corresponding to specific assessment points and analyses. All samples met recommended size for multivariate tests. However, samples intended for univariate test violated recommendations, with samples ranging from 57 participants to 75 participants with complete data sets.

RQ2. In a sample of children who attend Head Start, are group differences based on parent-reported primary language status at preschool entry (i.e., Primary Language English (PLE) vs. Primary Language Other (PLO)) evident in literacy scores (i.e., preschool PN, RH, and AL IGDIs and kindergarten DIBELS) at each test administration point?

Analyses. A one-way multivariate analysis of variance (one-way MANOVA) was utilized to determine if mean group differences existed on the IGDIs assessed in the spring of preschool. Specifically, performance on the IGDIs (i.e., three *dependent* variables in the case of this analysis) was examined based on two levels of one independent variable (i.e., parent-reported primary language status). Procedures suggested by Stevens (2002) were followed. *Wilks' lambda* was used to detect a significant difference in the overall model. Univariate tests were examined to determine if any individual dependent variable showed group differences on the levels of the independent variable. A sample size for main effects of MANOVA using statistical software (i.e., G*Power; Faul, Erdfelder, Lang, & Buchner, 2007) indicated that a sample of 48 participants would result in a power level of 0.80 when medium effect size and 0.05 alpha level were assumed. Further, interpolation of values provided by Stevens (2002, p. 200) suggested a sample with 41 participants per group (i.e., per level of independent variable) would be adequate to achieve 0.80 power. As indicated in Table 3, 86 participants had complete IGDI datasets, meeting sample size recommendations for analysis.

To determine primary language status group differences on kindergarten DIBELS variables, a series of univariate analysis of variance (ANVOA) tests and MANOVAs were conducted. It must be noted, however, that power to detect differences in the univariate tests were limited, as it is recommended that a two-group ANOVA contain 64 participants per group when utilizing an alpha level of 0.05 seeking to detect a power level of 0.80 (Cohen, 1992). As demonstrated in Table 3, sample sizes in the current investigation that were used to conduct ANOVAs ranged from 62 to 82 participants. Only minimally underpowered, 78 participants were used to conduct MANOVAs (to detect differences in DIBELS data).

RQ3. In a sample of children who attend Head Start, does parent-reported primary language status at preschool entry (i.e., Primary Language English (PLE) *vs.* Primary Language Other (PLO)) affect, or moderate, the predictive relations between IGDIs and DIBELS tests?

a. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten fall DIBELS (i.e., ISF and LNF) moderated by parent-reported language status (i.e., English PLE *or* PLO)?

b. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten mid-year DIBELS (i.e., ISF, LNF, PSF, and NWF) moderated by parent-reported language status (i.e., PLE *or* PLO)?

c. Are relations between preschool spring IGDIs (PN, RH, AL) and kindergarten spring DIBELS (i.e., LNF, PSF, and NWF) moderated by parent-reported language status (i.e., PLE *or* PLO)?

Analyses. In order to test for moderation in prediction, procedures outlined by Aiken and West (1991) were followed. First, the variable of interest (i.e., the variable being tested for moderation - primary home language status as English or Other) was dummy coded with "0" and "1." Next, the original predictor variables (i.e., IGDIs) were centered. After those variables were centered, multiplicative terms were created in order to test for moderation of the predictive relation between the literacy variables and primary language status.

Hierarchical MLR and MMLR procedures were employed. To control for PLS and original predictor variables (centered), those four variables (i.e., PN_c, RH_c, AL_c, Primary Language Status) were entered as the first step (reduced model). The second step included the full, seven predictor model including the interaction (multiplicative) terms (i.e., PN_c, RH_c, AL_c, Primary Language Status, PN_c x Primary Language Status, RH_c x Primary Language Status, and AL_c x Primary Language Status) were entered into the regression model (full model). All statistics described in the previous section addressing the first research question were interpreted.

In addition, for each univariate analysis (and each univariate level of significant multivariate analyses), change in R^2 (ΔR^2) was examined to determine whether additional predictors (i.e., using the full model) added a significant amount of variance to the model. When this was calculated for MMLR results, the formula presented in Figure 3 was utilized to determine an *F* value so statistical significance of the change could be determined. For each multivariate analysis, change in *Wilks' lambda* (Δ *Wilks' Λ*) was determined from the reduced to the full models using the formula in Figure 1. In order to determine the significance of this change, Rao's R was derived and used as an approximate *F* value through procedures described by Stevens (2002; see Figure 2).

Significant beta weights for Primary Language Status would indicate that there is a significant effect of that variable on the outcome variables (i.e., PLO or PLE group showing higher scores on outcome variable). Significant beta weights found for any of the multiplicative terms would indicate a moderation of strength in prediction based on primary language status. If any interaction terms had been found to be statistically significant predictors, simple slopes were planned to be plotted to facilitate interpretation of the of moderation effect.

Power analyses for these sets of MLR and MMLR analyses were also conducted based on procedures outlined by Cohen (1988; 1992) when estimating a medium effect size, utilizing an alpha of 0.5, and seeking to detect a power level of 0.80. For the univariate tests (i.e., 7 predictors, 1 outcome; fall ISF, fall LNF, and midyear ISF) to achieve a level of 0.80 power, a minimum sample of 102 was suggested (Cohen, 1992). Although these proposed analyses were underpowered (n = [57, 75]), procedures outlined for regression to test an interaction (i.e., moderation) were appropriate for determining the answer to the current research questions. The same criteria were utilized to determine appropriate sample size for the proposed the MMLRs using Cohen (1988; $f^2 = 0.15$, medium effect size). To meet those criteria, analyses suggested that a minimum sample size of 57 participants was necessary for a multivariate regression analysis using seven predictor and three outcome variables (midyear and spring assessments). Refer to Table 3 for the amount of participants with complete data sets.

Chapter IV: Results

Interobserver agreement. For IGDI measures, a second rater administration checklist and scoring was utilized to obtain interobserver agreement on approximately 25% of sessions for the overall evaluation project. Average inter-observer agreement for IGDI measures administered by Head Start teachers was 96.6% (Gischlar, 2009). IOA was obtained for approximately 100 kindergarten students attending the participating school district at one administration point using audio recordings of school personnel. Average total IOA was found to be at 97.5% for LNF, at 94.0%, for PSF, and at 71.7% for NWF.

Descriptive statistics. Descriptive summary information is presented for all predictor and outcome variables for the full sample, the PLO group, as well as for the PLE group. These data include sample sizes, means, standard deviations, and score range. Data are presented in Tables 4, 5, 6. Participant demographic information is presented in Table 1.

Normality and regression assumptions. Prior to analyses, the full data set was screened for normality and other assumptions associated with linear regression to determine appropriateness of these analyses. In addition to normality, these assumptions included homoscedasticity of the residuals, linear relationships between the outcome variable and the predictor variables, and the absence of multicollinearity. Assumptions for MANOVA (pertinent to research question two) are described in a subsequent section.

Skewness and kurtosis values were computed and histograms of standardized residuals were inspected for all variables to evidence univariate normality. Skewness and kurtosis values are presented in Tables 4, 5, and 6. All predictor and outcome variables except Mid-year and Spring NWF met criteria for having skewness coefficients between -2 and +2 and kurtosis coefficients between -7 and +7 (Curran, West, & Finch, 1996). NWF scores at both time periods had minimally elevated skewness (i.e., 2.42 at Mid-year and 2.19 at Spring) and kurtosis (i.e., 8.86 and 8.56, respectively) values. Visual inspection of histograms in addition to evaluation of Cook's Distance was then computed to further evaluate data patterns and inspect for outliers. Although Cook's Distance did not exceed |±1.00| for any variable, demonstrating no outliers existed on NWF in terms of that value (Cook & Weisberg, 1982), visual inspection indicated otherwise. Specifically, high outliers were found on Mid-year and Spring NWF.

To maintain interpretability and improve conditions of normality, NWF distributions were winsorized (Tukey, 1962). That is, the variables were transformed by limiting extreme variables at a set percentile. A 98% winsorization was performed for Mid-year NWF (i.e., one score changed) and a 95% winsorization was performed for the Spring NWF (i.e., three scores changed). Histograms of residuals of winsorized NWF variables were inspected and resulted in a normal pattern. Winsorized NWF distributions were utilized for all subsequent analyses. Further, to inspect data for bivariate normality, which suggests multivariate normality, scatterplots for all pairs of dependent variables were examined. Scatterplots were observed to have generally elliptical formations, indicating bivariate normality. Further, absence of multicollinearity was supported by a) low to moderate correlations among predictor variables (i.e., all values below a value of $r = 0.8$) and b) Variance Inflation Factors (VIF) and tolerance values within acceptable ranges (i.e., all tolerance >.10 and VIF > 0.2; Myers, 1990; Menard, 1995). Overall, tolerance values were in the .7 to .8 range and VIF values were in the 1.1 to 1.8 range, suggesting that multicollinearity was not problematic.

Homoscedasticity of the residuals was examined through residual scatterplots. Although most plots demonstrated that residuals were distributed approximately equally across dependent variables, some appeared to be slightly heteroscedastic. Analysis, however, is possible with heteroscedastic tendencies (Tabachnick & Fidell, 2007).

Relationships among predictor and outcome variables were examined for linearity through visual inspection of scatterplots, plots of observed versus predicted values, and through a Deviation from Normality statistic derived from a means comparison test through Statistical Packages for the Social Sciences (SPSS; IBM, 2012). Visual inspection of plots indicated that most relationships among predictor and outcome variables demonstrated linearity; however, some showed at least some deviation from linearity. Thus, the Deviation from Normality statistic was examined to determine if any predictor-outcome pairs were problematic. Statistical significance of the Deviation from Linearity ($p < .05$), indicated that pairs of variables were not linearly related. Only two pairs of primary outcome-predictor relationships were determined to be problematic: RH-IGDI with Spring LNF ($p \approx .026$) and with winsorized Spring NWF ($p \approx .001$). Relationships between PN-IGDI and AL-IGDI with outcome variables were not problematic in terms of this test. To preserve interpretability, no transformations were completed. Further, curvilinear relationships were not observed on visual inspection (Tabachnick & Fidell, 2007). Thus, these variable pairs were retained for analysis.

Missing Data: Of the 94 original participants followed from Head Start through Kindergarten, 5 children (5.3%) had no data on the predictor measures (IGDIs), resulting in 89 children having at least partially completed data on the predictor measure. An additional 3 children (3.1%) were missing one or more IGDI measure (i.e., RH and/or AL) and thus had an incomplete set of predictor variables. This resulted in 93% of participants having a complete set of predictor variables.

Further, it is important to note that most missing data occurred on the dependent variables. Regarding attrition, six additional participants (~6%) had no available kindergarten data at any time point. One additional child had no kindergarten data after the fall time point. Of the 89 participants who had information on at least one predictor variable, missing data on individual dependent variables ranged from 4.5 to 9%, including those who were considered in the attrition group (i.e., Fall LNF 7.8%, Mid-Year LNF 7.8%, Mid-Year PSF 7.8%, Mid-Year 4.5%, Spring LNF 9%, Spring PSF 7.8%, Spring NWF 9%). As previously mentioned, missing data on DIBELS ISF was systematic in that it was not administered to Cohort 1.

Because more than 5% of individuals had missing data on individual variables (ranging from 4.5 to 9%), use of multiple imputation procedures was considered (Tabachnick & Fidell, 2007); however, after inspection of the data it was determined that listwise deletion of cases would be employed. First, data were examined to determine the underlying missing data mechanism (Enders, 2010). That is, data were explored to determine if data were Missing Completely at Random (MCAR), Missing at Random (MAR), or Missing Not at Random (MNAR). When missing data are MCAR, the probability of a variable being missing does not depend on any other variable in the model (Allison, 2009). MCAR data are considered to be missing at "purely haphazard missingness" (Enders, 2010, p. 7). In other words, the remaining sample is a random sample of values of a complete data set. Missing data are MAR when a missing data on a certain variable is related to another variable in the model, but not on the value of the missing variable. When missing data are MNAR, missing data on a particular variable are related to the value of the variable itself. Determining the missing data mechanism is critical to which procedures can be used to address the missing data.

To determine the underlying missing data mechanism, a Missing Values Analysis with Little's chi-square MCAR was conducted using SPSS (IBM, 2012). Little's chi-square MCAR test was used to evaluate whether missing data a) were MCAR or b) required further evaluation to determine whether missing data were MAR or MNAR. The null hypothesis of the test indicates that data are MCAR (IBM, 2010). Results of Little's test when applied to the current investigation suggested that data were MCAR for all analyses excluding those with ISF as an outcome variable. Results of Little's MCAR test were as follows: Fall LNF ($X^2 = 16.84$, df = 12, $p = .156$); Midyear LNF, PSF, NWF ($X^2 = 49.28$, df = 37, $p = .085$); and Spring ($X^2 = 35.64$, df = 39, $p = .624$). Since data were found to be MCAR, the investigator cautiously proceeded utilizing listwise deletion, as it was suggested by Little's test that biased outcomes due to the deletion would not be problematic (Enders, 2010).

The fact that the majority of missing data occurred on dependent variables was also used as rationale for utilizing listwise deletion instead of multiple imputation procedures, as some sources do not suggest using multiple imputation for deriving dependent values (e.g., Tabachnick & Fidell, 2007). In other words, using multiple imputation procedures is more valuable for imputing predictor variables than outcome variables. For instance, Allison (2011) suggested that if there are only some cases with missing data on predictors, and there are no strong auxiliary variables to add information to the multiple imputation procedure, imputing data on the dependent variable does not result in significant improvement. Further, von Hippel (2007) noted that ". . . using imputed Ys can add needless noise to the estimates" without later deleting those imputed Y values (p. 83). In other words, there is more value in using multiple imputation to complete predictor variables. In the current investigation, only about 6% of participants have missing data on predictor variables.

RQ1: In a sample of children who attend Head Start, what is the predictive validity of the IGDI scores obtained in the spring of preschool on subsequent DIBELS scores collected during kindergarten?

> **H1:** Based on results from Missall and colleagues (2007), it is hypothesized that low to moderate, statistically significant correlations will be found among *IGDI* and *DIBELS* measures at all points across kindergarten. Based on the work of Leichman and Shapiro (2009), omnibus multivariate models for three kindergarten time points will also be significant; however, *RH IGDI* scores will show weaker and possibly non-significant connections to the DIBELS measures than *PN* and *AL IGDI* scores. This is also supported by the NELP (2009) finding that rhyming is one of the least predictive skills of later literacy.

Summary. Pearson product-moment correlations and linear regressions (univariate and multivariate) were employed to answer RQ1. In sum, hypothesis one was partially met. Specifically, Pearson product-moment correlations were completed in order to explore the general relationship between the IGDI and DIBELS measures. Correlations were completed for the full sample, the PLE group, as well as for the PLO group. Low to moderate correlations were found among IGDI and DIBELS measures; however, this did not hold true across time points. Generally, stronger associations were found within IGDI and DIBELS variable than between them. Further, associations between RH-IGDI and DIBELS measures were generally weaker (and less frequently statistically significant) than those between PN-IGDI and DIBELS. However, tests of dependent correlations (Steiger, 1980) between pairs of correlations only resulted in four specific comparisons in which statistically significant differences were found. Of these four comparisons, two resulted in RH-IGDI and AL-IGDI having stronger associations with DIBELS and two resulted in PN-IGDI having stronger associations with DIBELS. Tables

7, 8, and 9 present the correlations among measures and time points for each group, respectively. Table 10 presents results of tests of dependent correlations.

Statistically significant prediction was found through regression analysis only at Mid-Year DIBELS, with IGDIs explaining approximately 28% of the multivariate outcome (i.e., LNF, PSF, NWF). Further examination indicated that the three IGDI predictors combined significantly explained approximately 15% of the variance in LNF and approximately 18% of the variance in PSF. Examination of the individual beta weights of each predictor suggested that only PN significantly predicted LNF and PSF.

Correlations among IGDIs. Low to moderate statistically significant correlations were found among IGDI variables for the total sample. Correlations ranged from .297 ($p < .01$) to .438 ($p < .001$), with the strongest associations among the phonological awareness measures (RH and AL). For primary English speakers (i.e., PLE), moderate statistically significant correlations were found, ranging from .356 ($p < .01$) to .662 ($p < .001$). Similarly to the overall group, correlations among the phonological awareness measures were strongest. Finally, statistically significant correlations were not found among IGDI measures. However, this could be due to the low number of children in that group ($n = 35$).

Correlation among DIBELS. Correlations among DIBELS measures for the full sample ranged from being low and statistically non-significant ($r = .169$, $p > .05$) between Fall ISF and Spring PSF to high ($r = .773$, $p < .001$) between Spring LNF and Spring NWF. Generally, correlations among and between letter naming and nonsense words were strongest. Correlations among DIBELS measures for the PLE group fell in a similar range. That is, correlations ranged from being low and statistically non-significant ($r = .172$, $p > .05$) between Fall ISF and Spring PSF to high ($r = .779$, $p < .001$) between Spring LNF and Spring NWF. For the PLO group, correlations were comparable: low and statistically non-significant ($r = .175$, $p > .05$) between Fall ISF and Spring PSF to high ($r = .772$, $p < .001$) between Spring LNF and Spring NWF.

Correlations between IGDIs and DIBELS. Overall, correlations ranged from low and statistically non-significant ($r = .012$, $p > .05$) between AL-IGDI and Mid-year ISF as well as Spring NWF to moderate ($r = .397$, $p < .01$) between PN-IGDI and Mid-year PSF. Overall, correlating PN-IGDI with subsequent DIBELS measures resulted in the strongest correlations. Statistically significant correlations were found between PN-IGDI and LNF as well as between PN-IGDI and PSF consistently across time points. Correlations among RH-IGDI and DIBELS measures did not result in statistically significant correlations. Correlations between RH-IGDI and Mid-year LNF, Mid-year PSF, and Spring LNF approached statistical significance ($p < 0.1$). Correlation results within the two subgroups (PLO and PLE) revealed similar patterns, with PN-IGDI being associated with the strongest overall correlations. Overall, correlations were strongest at the Mid-year time period, and specifically between PN-IGDI and LNF as well as PN-IGDI and NWF over time.

Test of dependent correlations. The test of dependent correlations (Steiger, 1980) was conducted among correlations from the full sample between IGDI and DIBELS measures. This was completed in order to determine whether or not statistically significant differences in correlations existed based on specific IGDI measure. That is, correlations between PN-IGDI and DIBELS measures were compared to corresponding correlations between RH-IGDI and DIBELS measures, which were compared to those between AL-IGDI and DIBELS measures, and so on. Results in terms of *z*-scores are presented in Table 10. Of eighteen comparisons, only four were found to have statistically significant differences. Specifically, correlations between RH- and AL- IGDI and Fall ISF were stronger than the correlation between PN-IGDI and Fall ISF.

Alternatively, the correlation between PN-IGDI and Spring PSF was stronger than those between Spring PSF and RH- and AL-IGDI. All other comparisons did not result in statistically significant differences.

Multiple Regression. In determining the predictive relationship between the IGDI and the DIBELS measures, both univariate and multivariate multiple linear regressions (MLRs and MMLRs) were conducted. All regression models utilized IGDI scores as simultaneously entered predictor variables. Univariate analyses were conducted for Fall kindergarten outcome measures (ISF and LNF) and Mid-year ISF. Multivariate tests were utilized to determine prediction of the remaining Mid-year measures (i.e., LNF, PSF, NWF) as well as for all Spring measures (LNF, PSF, NWF). For each univariate regression analysis, amount of explained variance and specific relations between individual predictors and outcome variables were derived. For multivariate regression analysis, overall multivariate regression significance was determined. If the omnibus result was significant, the amount of explained variability for each dependent variable, and specific relations between individual predictors and outcome variables were determined. The following describes each outcome. Tables 11, 12, and 13 provide specific results.

Fall DIBELS. Overall, IGDI measures did not significantly predict Fall DIBELS measures (i.e., ISF, LNF). The model explained statistically non-significant proportions of variance in the outcome measures (ranging from 5 to 7%). Results are presented in Table 11.

Mid-year DIBELS. Although IGDI measures did not significantly predict Mid-year ISF scores, a significant multivariate effect was found when using the three IGDI measures to predict Mid-year LNF, PSF, and NWF. Specifically, the MMLR resulted in a *Wilks' Λ* value of .72 (F (9, 158.34) = 2.55, $p < .01$), indicating that the IGDIs explain approximately 28% (i.e., 1 – 0.72) of variance in the three dependent variables, overall. This model explained approximately 15%

of LNF and approximately 18% of PSF. The model did not explain a statistically significant amount of variance in NWF. Of the individual predictors, only one significantly contributed to the prediction (i.e., IGDI-PN; $\beta = .25$, $p < 0.05$ for LNF; $\beta = .33$, $p < 0.01$ for PSF). RH-IGDI and AL-IGDI did not contribute significantly to the prediction model. Specific results are presented in Tables 11 and 12.

Spring DIBELS. MMLR was conducted to determine if IGDI scores would significantly contribute to Spring DIBELS scores almost one year later. Results indicated that the overall prediction model was statistically non-significant, yielding a *Wilks' Λ* value of .84 (F (9, 158.34) = 1.26, $p = .261$). Since the result of the multivariate test was statistically non-significant, univariate results are not examined.

Mid-year to Spring change scores. Change scores for variables between Mid-year and Spring were calculated by subtracting the Mid-year score from the Spring score. These scores were used as outcome variables (i.e., ΔLNF, ΔPSF, ΔNWF). MMLR was conducted to determine if IGDI scores would significantly contribute to Spring DIBELS scores almost one year later. Results indicated that the overall prediction model was statistically non-significant, yielding a *Wilks' Λ* value of .80 (F (9, 151.04) = 1.63, $p = .111$). Since the result of the multivariate test was statistically non-significant, univariate results are not examined.

RQ2. In a sample of children who attend Head Start, are group differences based on parent-reported primary language status at preschool entry (i.e., English Primary Language English (PLE) vs. Primary Language Other (PLO)) evident in literacy scores (i.e., preschool PN, RH, and AL IGDIs and kindergarten DIBELS) at each test administration point?

> **H2.** Technical Report research on Dual Language Learners and *IGDI* performance (Estrem & McConnell, 2008) suggests that primary home language affects mean levels on all three *IGDI* scores, with primary English speakers scoring higher than Dual Language Learners. Thus, it is hypothesized that the PLE group will have higher *IGDI* scores at end of preschool than the PLO group. Further, based on DLL vs. non-DLL group differences found on DIBELS-like kindergarten literacy measures with non-DLL students outperforming others (Betts, Reschly, Pickart, Heistad, Sheran, & Marston, 2008), it was hypothesized that students reported as having a primary language of English, overall, will yield higher mean scores than the DLL group on kindergarten DIBELS measures.

Summary. Group differences on literacy variables based on Primary Language status were examined through multivariate and univariate analysis of variance. The current hypothesis was partially supported for IGDI measures, with the PLE group outperforming the PLO group on PN. There were no statistically significant group differences on RH or AL. The current hypothesis related to kindergarten DIBELS measures was not supported, with no statistically significant group differences based on language status for any DIBELS measure at any administration time point. Table 14 displays specific results.

Group differences. A one-way multivariate analysis of variance (MANOVA) was utilized to explore differences on IGDI variables across the two parent reported language groups (i.e., PLE and PLO). Univariate and multivariate normality information, assumptions of MANOVA, are presented in a previous section. Homogeneity of covariance is an additional assumption of MANOVA and was tested through Box's Test of homogeneity of covariances (Stevens, 2009). According to Stevens, this assumption is "very restrictive" (p. 228) and quite sensitive to violations if there are any small variations from multivariate normality. Statistical non-significance of the test indicates that the assumption is met, showing similarity (homogeneity) across covariance matrices. Alternatively, statistical significance indicates that the assumption was not met. Box's text for the current MANOVA was statistically significant (*F*

(6, 36165.19) = 2.36, $p < 0.05$); thus, results should be interpreted with caution. However, MANOVA is robust to this assumption when group sizes are approximately equal (i.e., largest group ($n = 51$) is less than 1.5*smallest group ($n = 53$); Stevens, 2009). Further support for use of a MANOVA in the current context was evident through individual Levene test results, which demonstrated equality of error variances in a univariate context for PN IGDI (F (1, 84) = 1.02, $p = .315$), RH IGDI (F (1, 84) = 1.18, $p = .280$), and AL IGDI (F (1, 84) = 0.58, $p = .450$). Results are presented in Table 14.

IGDIs. MANOVA results revealed a multivariate main effect for Parent-reported Primary Language (*Wilks'* $\lambda = .90$, F (3, 82) = 2.92, $p < .05$, $n = 86$). Follow-up one-way ANOVAs for each group were conducted. A statistically significant difference in emergent literacy score based on Primary Language groups was evident for one of the tested variables. That is, a statistically significant differences based on group status was found for PN (F (1, 84) = 6.273, $p < .05$; PLE children scoring higher than PLO children), but not for RH (F (1, 84) = .283, $p = .596$), or AL (F (1, 84) = .988, $p = .323$).

Fall DIBELS. Two separate one-way ANOVAs were conducted. Overall results indicated no statistically significant group differences detected based on language status (i.e., PLE vs. PLO) on Fall ISF (F (1, 61) = .013, $p = .909$) and LNF (F (1, 80) = .768, $p = .383$) scores.

Mid-year DIBELS. A one-way ANOVA was conducted to determine if statistically significant differences existed between language status groups on Mid-Year ISF scores. No statistically significant differences were found (F (1, 60) = .595, $p = .444$). A MANOVA was utilized to determine if group differences existed on LNF, PSF, and NWF scores at mid-year.

Results indicated no statistically significant multivariate main effect (*Wilks'* λ = .94, F (3, 74) = 1.54, p = .212, n = 78), thus, univariate differences were not examined.

Spring DIBELS. A MANOVA was utilized to determine if group differences existed on LNF, PSF, and NWF scores at mid-year. Results indicated no statistically significant multivariate main effect (*Wilks'* λ = .97, F (3, 74) = .59, p = .627, n = 78), thus, univariate differences were not examined.

RQ3. In a sample of children who attend Head Start, does parent-reported primary language status at preschool entry (i.e., Primary Language English (PLE) *vs.* Primary Language Other (PLO)) affect, or moderate, the predictive relations between IGDIs and DIBELS tests?

> **H3.** As the participants are expected to differ in primary language exposure and use (i.e., preschool entry, parent-reported Primary Language English (PLE) vs. Primary Language Other (PLO)), and test administration was conducted in an English-only context, it is expected that the preschool IGDIs will differentially function as a predictor of subsequent kindergarten literacy skills for each language status group.

Summary. Although the full and reduced models significantly predicted Mid-year DIBELS measures, and adding the multiplicative terms (interaction terms) to the prediction added significant variance to the prediction model, PLS did not moderate the predictive relationship among IGDIs and Mid-year DIBELS. Thus, the hypothesis was not supported. Neither Fall nor Spring DIBELS measures were predicted by IGDIs (centered), PLS, and multiplicative terms. Further, PLS did not serve as a significant predictor, indicating that there were no significant differences on outcome variable based on PLS (reflecting results of research question 2).

Hierarchical Multiple Regression. To answer the third research question, (i.e., testing potential moderation effects of language status in the regression models) both univariate and multivariate hierarchical multiple linear regressions (MLRs and MMLRs) were conducted. All regression models utilized Primary Language Status (PLS, dummy coded) and centered IGDI scores as predictors in the first (reduced) model, and added interaction terms (dummy coded PLS x centered IGDI) to complete a second (full) prediction model. PLS and centered IGDIs were entered first to control for their prediction effects when determining potential interaction (moderation) effects. Similar to the analyses conducted to address research question one, univariate analyses were conducted for Fall kindergarten outcome measures (ISF and LNF) and Mid-year ISF. Multivariate tests were utilized to determine prediction of the remaining Mid-year measures (i.e., LNF, PSF, NWF) as well as for all Spring measures (LNF, PSF, NWF). For each univariate regression analysis, amount of explained variance and specific relations between individual predictors and outcome variables were derived. For multivariate regression analysis, overall multivariate regression significance was determined. If the multivariate omnibus result was significant, the amount of explained variability for each dependent variable, and specific relations between individual predictors and outcome variables were determined. Further, significance in the model change, or any additional variance explained, was determined for both univariate (ΔR^2) and multivariate (Δ *Wilks' Λ*) tests. The following describes each outcome. Tables 15 through 19 provide specific results. Figures 1, 2, and 3 present formulas used to derive a comparison of *Wilks' Λ* (J.G. Lutz, personal communication, March 6, 2012), *Rao's F* approximation (Stevens, 2002), and an F-test and significance test for ΔR^2 within a multivariate regression (Maxwell & Delaney, 1990).

Fall DIBELS. Overall, proposed models did not significantly predict Fall DIBELS measures (i.e., ISF, LNF). Specifically, models one and two of the regression analysis predicted a statistically non-significant amount of the variance in ISF (F (4, 53) = .958, p = .439; R^2 = .07; F (7, 50) = .691, p = .679; R^2 = .09) and LNF (F (4, 70) = .953, p = .439; R^2 = .05; F (7, 67) = 1.119, p = .362; R^2 = .11). The change in the amount of variance explained was also statistically non-significant for models predicting ISF (Δ F (3, 50) = .381, p = .767) and LNF (Δ F (3, 67) = 1.323, p = .2.74). Because overall models (reduced or full) did not predict statistically significant amounts of variance in ISF or in LNF, individual beta weights were not interpreted, and no interaction effects showed statistical significance. Thus, no interaction effects (moderation) were evident. Results are presented in Tables 15 and 16.

Mid-year DIBELS. Although neither regression model predicted Mid-year ISF scores with statistical significance (F (4, 52) = .111, p = .978; R^2 = .01; F (7, 49) = 1.005, p = .439; R^2 = .13; Δ F (3, 49) = 2.186, p = .101), a significant multivariate effect was found when predicting LNF, PSF, and NWF collectively.

Specifically, model one of the MMLR resulted in a *Wilks' Λ* value of .685 (F (12, 169.62) = 2.17, p < .05), indicating that PLS and centered IGDIs explain approximately 31.5% (i.e., 1 – 0.685) of the variance in the three dependent variables (LNF, PSF, NWF), overall. Since the multivariate test was significant, the R^2 values were interpreted. This model explained approximately 17% (p < .05) of LNF and approximately 19% of the variance in PSF (p < .01). Model one did not explain a statistically significant amount of variance in NWF. Of the individual predictors, when holding all other predictors constant, only one significantly contributed to the prediction (i.e., IGDI-PN; β = .36, p < 0.05 for PSF). This indicates for every one standardized unit increase in IGDI-PN, there is a .36 standardized unit increase in PSF.

Using an unstandardized weight to enhance interpretability, when holding all other predictors constant, a one unit increase in IGDI-PN related to a .81 increase in PSF. Other individual predictors in the model did not contribute significantly to the outcome variables.

Model two also predicted a significant amount of variance in the multivariate context (*Wilks' Λ* = .559 (F (21, 175.71) = 1.88, p < .05)). Model two predicted 44% (i.e., 1 – 0.559) of the variance in the outcome variables. Further, the resulting change in the additional amount of variance explained was statistically significant (Δ Wilks' Λ = .816; *Rao's F approximation* = 2.353,p <*.05*). Of note, the change in *Wilks' Λ* was determined by comparing the full model *Wilks' Λ* to the reduced model *Wilks' Λ* through ratio (see Figure 1). *Wilks' Λ* was then converted to *Rao's F* approximation using procedures outlined by Stevens (2002; see Figure 2) in order to determine its level of statistical significance.

Variance explained in each of the individual dependent variables was then examined. Model two continued to predict significant amounts of variance in LNF (R^2 = .21) and PSF (R^2 = .21), showing very small increases from the previous model. Change in explained variance from model one to model two was not statistically significant for LNF (F (3, 63) = 1.063, p = .371) or for PSF (F (3, 63) = .531, p = .662). Specific F test procedures for model comparisons of the change in R^2 were outlined by Maxwell and Delaney (1990; see Figure 3). Further, no additional predictor variables significantly predicted the outcome variables, indicating no significant interaction (moderation) effects. Specific results are presented in Tables 17 and 18.

Spring DIBELS. Hierarchical MMLR was conducted with two separate regression models to determine if PLS served as a moderator of the predictive relationship between IGDIs and Spring DIBELS scores (LNF, PSF, NWF) almost one year later. Results indicated that the overall prediction from model one was statistically non-significant, yielding a *Wilks' Λ* value of

.793 (F (12, 169.62) = 1.29, p = .226). Since the result of the multivariate test was statistically non-significant, model one univariate results are not examined. Similarly, the result of model two regression analysis was not statistically significant (*Wilks' Λ* = .672 (F (21, 175.71) = 1.24, p = .223). Further, although adding the interaction terms as additional predictor variables in model two improved the model slightly, the additional variance predicted in the multivariate model was not statistically significant (Δ *Wilks' Λ* = .847; *Rao's R* = 1.898, p = .085). Since multivariate predictions were not significant, univariate results were not interpreted, and no moderation effects were determined. Results are presented in Table 19.

Chapter V: Discussion

The purpose of this investigation was to examine the predictive validity of the *Individual Growth and Development Indicators* on the kindergarten measures of the *Dynamic Indicators of Basic Early Literacy Skills (6th edition).* This study specifically examined a group of children who attended Head Start, some of whom with a parent-reported home language other than English which was most frequently Spanish. By posing three overarching research questions, its aim was to expand the current literature base by establishing additional and concrete connections between the IGDIs at the end of a preschool year and DIBELS administered at three time points throughout kindergarten. In addition, the study sought to provide information on how these measures functioned specifically for young children considered to be Dual Language Learners, defined through parent-reported home language. Subgroups of 4-year-old children from the three cohorts who entered a single school district in Eastern Pennsylvania, totaling 94, were followed from Head Start preschool classes through kindergarten. Pearson product-moment correlations as well as univariate and multivariate multiple linear regressions were employed to determine overall predictive validity. Univariate and multivariate analyses of variance were conducted to compare the performance of participants based on Primary Language Status (i.e., English or Other) on all literacy variables. Hierarchical univariate and multivariate multiple linear regression that included interaction terms in the prediction model were utilized to determine whether Primary Language Status moderated the strength or level of the predictive relationship between IGDIs and DIBELS.

Predictive Validity of IGDIs

The hypothesized predictive nature of the Picture Naming, Rhyming, and Alliteration IGDIs on the kindergarten DIBELS measures was partially supported by correlation and multiple regression procedures. Results of correlations indicated that PN showed the strongest connections and RH showed weakest connections to DIBELS measures overall. In the Fall, only PN was significantly associated with LNF. At Mid-year, PN and AL were correlated with LNF and PSF. Correlations between those measures and RH approached conventional levels of significance (i.e., $p < .10$), indicating significance may have been detected with a larger sample size. By the end of the year (Spring), only PN remained significantly associated with outcome measures (PSF and LNF).

Interestingly, IGDI measures only predicted Mid-year kindergarten literacy variables (i.e., DIBELS LNF, PSF, NWF) with statistical significance. Upon further examination, it was determined that the group of IGDI variables significantly predicted both LNF and PSF, but not NWF. PN IGDI was the only predictor variable that was significantly related to DIBELS measures, with a one unit increase in LNF for every .64 increase in PN score, and one unit increase in PSF for every .74 increase in PN score when RH and AL are held constant.

The findings demonstrating that Picture Naming (vocabulary, oral language, rapid automatic naming) predicted Phoneme Segmentation Fluency (phonological awareness and processing) as well as Letter Naming Fluency (rapid automatic naming of graphological images) is consistent with several other research studies. For instance, McCormick and Haack (2010) used preschool IGDIs to predict kindergarten DIBELS measures and subsequent conventional reading tasks. Results indicated that PN as well as AL were significantly correlated with fall LNF and Mid-year PSF. Similar to the current study, RH generally demonstrated the weakest associations with kindergarten DIBELS measures with the exception of its association with Mid-year PSF. Cabell, Justice, Konold, and McGinty (2011) also found weak predictive relationships between RH and later early literacy measures (r ranging from .17 to .23) in a study assessing emergent literacy profiles (described later in this section). The overall strength in correlation and prediction of PN as compared to AL and RH may be explained by a few possibilities. First, naming pictures that are commonly found in a child's environment is a more naturalistic task than a more discrete phonological access task presented in a formal setting. Second, the automaticity necessary to respond correctly in the PN task is not required for the AL and RH tasks and may be representative of something additional to oral language, such as processing speed. Finally, for the DLL students, PN may be serving as a rudimentary proxy for English language development or level, and may have served as a better connection to later literacy development in the current sample.

As another example, linking oral language to phonological awareness in a study conducted by McDowell, Lonigan, and Goldstein (2007), various predictors of phonological awareness were assessed in a large group of children ranging in age from 2- to 5-years-old. Results indicated that vocabulary, in addition to child socioeconomic status, age, and speech sound accuracy, each uniquely contributed to the prediction of phonological awareness. Further, Metsala (1999) found that in a group of three- to five-year-olds, vocabulary growth was strongly associated with phonological awareness. Storch and Whitehurst (2002) also found that preschool oral language was predictive of subsequent kindergarten early literacy skills including phonological tasks and code-related as well as orthographical tasks. As another example, Cooper and colleagues (2002) found similar results when examining a group of children (including some DLLs) in that oral language predicted concurrent and subsequent phonological awareness.

Although some current findings were consistent with previous research, overall results demonstrated weaker and less frequently significant relationships between IGDI and DIBELS at the kindergarten transition period than did previous research (e.g., Missall, et al., 2007;

Leichman & Shapiro, 2009). IGDIs used in the present study are purported to measure oral language through rapid automatic naming of pictures and phonological awareness through the rhyme and alliteration metrics (ECRI-MGD, 2000). Generally weak associations between measures and relatively limited predictive ability of the IGDI scores to the DIBELS scores in the current sample lead an individual to question other factors that may have impacted the relationship between those measures. In particular, it was surprising that IGDI phonological awareness (RH and AL) did not significantly predict kindergarten literacy measures, particularly those related to phonological awareness and decoding at Mid-Year.

Explaining the sources of variance unaccounted for by the prediction models in the current study lends to exploration of both literacy based and non-literacy based factors. First, it should be considered that some literacy variables, or ways in which those literacy skills are assessed, may lead to stronger prediction of later literacy acquisition and therefore potentially more valuable to assess. For instance, NELP (2007) reported that rapid automatic naming of graphological images (r = .44) showed stronger overall correlations to decoding than did rapid naming of nongraphological images (r = .33). Further, it was reported that within the domain of oral language, vocabulary (r = .24) showed relatively weak correlations to decoding as compared to other measures of oral language such as grammar (r = .47) or definitional vocabulary (r = .38). Also, and importantly, phonological awareness (r = .45) showed almost equal correlational strength to subsequent decoding as did alphabetic knowledge (r = .46) and concepts of print (r = .46). Finally, it was reported that rhyming measures were not strong indicators of phonological awareness acquisition, which was paralleled in the current sample. Together, these points suggest metrics in alternate areas (e.g., defining words or objects, reciting the alphabet, or possibly rapid letter naming) may be stronger than some currently tested by the IGDIs.

In addition, the specific sample should be considered in relation to literacy performance. Although the current study included only young children who attended Head Start in an effort to enhance internal validity, it should be noted that young children who are considered to be in an "at-risk" group likely represent a heterogeneous group in terms of literacy performance (Cabell, et al., 2011). Cabell and colleagues administered code-related and oral language measures to a group of 492 preschoolers and determined that the group, overall, consisted of children that represented five literacy profiles. Of note, DLLs were included in the study but separate results were not reported. Identified profiles were based on language and code-related performance: one overall high group, three groups with average oral language and different levels of code-related skills, and one with low oral language and code-related weakness. Profiles were not only indicative of performance on literacy skills, but also affected predictive relationships with subsequent literacy skills. Thus, in the current case, potential heterogeneity of the sample may have affected prediction.

Further, approximately 40% of the current sample was identified as being exposed to or using a primary language other than English in the home setting. Having such a large DLL subgroup in the current sample likely impacted results in that DLLs have language and literacy acquisition processes that may differ from those of their monolingual English-speaking peers. In other words, basic assumptions made regarding the relationships among literacy constructs important for monolingual English speakers may not hold for DLLs. Regarding oral language development, for instance, some children exposed to bilingual environments (home and/or school) have lower expressive vocabularies than those of their monolingual peers (Hammer, et al., 2011). Further, DLLs are exposed to languages that vary in terms of quality, quantity, and even patterns across caregivers and settings (De Houwer, 2007; Hart & Risley, 1995).

Research regarding the literacy development of young DLLs is limited when compared to research targeting young monolingual children (Gutiérrez, et. al, 2010). Overall, results of this emerging research are mixed and complex. For instance, some research (e.g., Branum-Martin, et al., 2006) suggests that constructs and relations in children's primary language functions similarly for Spanish-speaking children when tested in Spanish as they do for English-speaking children when tested in English. Additionally, cross-language transfer of phonological awareness has been demonstrated by several studies (e.g., Lindsey et al., 2003; Dickinson & colleagues, 2004; Branum-Martin, 2006). However, other research demonstrated stronger within-language associations of emergent literacy skills (Farver et al., 2007; Anthony, et al., 2009). In sum, the complex and largely under-explained nature of emergent literacy development for DLLs may have contributed to current results. Certainly, more research is needed assessing DLLs in both their home language and English across time to determine whether constructs and predictions shown to be important for monolingual English emergent literacy development hold for children who are DLLs. Next, there are several other non-literacy specific variables can certainly impact literacy acquisition, and may have had much stronger influence on kindergarten performance than a single assessment at the end of preschool. Todd (2010), for example, examined multiple child-level and environmental factors to determine if they impacted literacy performance and development during preschool as assessed by the IGDIs across four time points. Overall results indicated that child race, attendance, general classroom environment, and class size significantly impacted PN. Phonemic awareness (RH and/or AL) was significantly associated with gender, household socioeconomic status, and teacher level of education. Further, behavior and within-child protective factors such as initiation, self-control, and attachment were related to growth on PN. It is clear that several factors relate to literacy development. In the current sample and investigation, inclusion of these child-specific and environmental variables may have led to significant prediction.

It is also possible that various methodological differences could have resulted in different predictive outcomes. Use of univariate tests, for instance, could have resulted in detecting specific predictions that were not able to be interpreted in the multivariate context. Combining three separate cohorts, threatening internal validity, may have also contributed to these unexpected results. Limited sample size may have also diminished ability to detect significant predictions. Further, had the timing of Primary Language Status determination been closer to the time of literacy assessment (e.g., at the end of preschool or beginning of kindergarten), outcomes may have differed. Specifically, the group of children identified may have been comprised of fewer children, and predictive relations between literacy measures may have been different for those children who acquired English faster than others. Some of these issues are further delineated in a separate section.

Primary Language Status, Literacy Variables, and Test for Moderation in Prediction

Levels of both predictor and outcome literacy variables (IGDIs and DIBELS) were assessed based on student Primary Language Status (PLS). PLS was determined through caregiver report on the Home Language Survey. Participants were categorized as having a PLS of English (PLE) or PLS of Other (PLO). Of the students identified as PLO, approximately 95% were identified as Spanish-speaking or having been exposed to Spanish in the home environment. Contrary to the hypothesis that the PLE group would outperform the PLO group on literacy variables, both groups performed equally well on all measures but the PN-IGDI. That is, multivariate and univariate analyses of variance resulted in a statistically significant difference only on PN, with the PLE group scoring higher than the PLO group.

A series of hierarchical multiple linear regressions (univariate and multivariate) were conducted including interaction terms as predictors in order to determine whether parent-reported Primary Language Status moderated the predictive relationship between IGDI and DIBELS measures. In sum, the hypothesis that language status would moderate the predictive relationship among variables was not supported in this sample. This is despite the fact that the overall prediction model significantly predicted Mid-year DIBELS measures, and adding the multiplicative terms (interaction terms to test for moderation) to the prediction added significant variance to the prediction model.

Insight into DLLs that attend Head Start may aid in providing context for the current results. When reporting results on developmental progress on DLLs in Head Start, a report to congress (U.S. Department of Health and Human Services, 2013; US DHHS) emphasized that a) there is a lack of consensus on appropriate measurement procedures and tools to address language screening as well as several other developmental domains for DLLs, and b) well-established and widely-available measures normed for primary English-speakers are often not valid for DLLs. Several findings of the report relate to results, and factors that may have affected results, of the current investigation.

The first major issue to consider is how the grouping variable, Primary Language Status, was constructed. In the current investigation, caregivers indicated their child's primary language spoken at home through a Home Language Survey at preschool entry. This was the typical methodology employed for studies reviewed for the US DHHS (2013) report. Typically, DLLs were defined as children who lived in a home where a language other than English was spoken, often regardless of which language was dominant. In fact, nearly one-fourth of children considered to be DLLs also had English spoken in the home. That said, in the current investigation, as in other research, children identified as being PLO represented a heterogeneous group that may or may not have related to a child's English language or literacy fluency and performance. The problematic nature of this methodology and suggestions for improvement are further described in the next section.

This report also indicated that the majority of DLLs in Head Start are exposed to adults speaking both English and children's home languages. Further, multiple languages are typically used both in the classroom and during home visits (US DHHS, 2013). If DLLs in the current sample are representative of the majority of DLLs in Head Start, they, too, are exposed to multiple languages at both home and school. This further supports the hypothesis that the group is heterogeneous. Further, research demonstrates that varying levels of language exposure can affect literacy outcomes. For example, in a study examining English and Spanish emergent literacy skills in a group of Spanish-English DLLs, Durán, Roseth, and Hoffman (2010) found that type of instruction and amount of Spanish-language exposure affected emergent literacy outcomes.

Interestingly, the report also indicated that, per teacher report, both literacy skills and learning readiness are similar for DLLs and children from monolingual English homes both at the beginning and end of Head Start. Although this was not validated with more objective measurement, it is interesting in that it reflects the current findings that only one literacy variable showed a statistically significant difference based on PLS (i.e., PN). Further, even that difference was minimal, showing only a four point mean difference. In other words, although this difference was statistically significant it may not be clinically meaningful (Kazdin, 2003).

Finally, the concept of bilingualism itself should be addressed in relation to the development of literacy. Bialystok (2007) proposes this through a research framework that addresses how oral language, understanding concepts of print, and metalinguistic awareness (requirements for literacy development in monolingual children) may develop differently for bilingual children. Overall, Bialystok asserts that bilingual children may have an advantage in the development of concepts of print and a disadvantage in the development of oral language competence, but arguably little difference in developing metalinguistic concepts. In addition, constructs such as phonological awareness may demonstrate cross-language transfer (Lindsey, et a., 2003; Dickinson, et al., 2004; Branum-Martin et al., 2006; Anthony, et al., 2009) while skills such as decoding may be more language-dependent (Bialystok, Majumder, & Martin, 2003). In other words, bilingualism itself is a contributing factor to the development of literacy and should be taken into consideration when planning research and intervention.

Limitations and Directions for Future Research

There are several limitations to the current investigation. First, the small sample size of the study was potentially problematic in terms of having adequate statistical power to detect significance in analyses. Additionally, although there are benefits to conducting multivariate analyses when possible (e.g., reduction of Type I error), participants were excluded when they were missing even one outcome variable. Power was further diminished in analyses using Mid-Year and Spring data due to participant attrition. Of note, high sample attrition is not uncommon when working with families and children considered to be at-risk (Pan, Rowe, Spier, & Tamis-LeMonda, 2005). Certainly, replication with a larger sample size is warranted.

Second, the current combined sample consisted of three separate cohorts of children, each of which entered Head Start on separate, consecutive years. Although children were of similar age at assessment, assessments were consistent across cohorts, and the kindergarten school district was the same for all students, combining the groups may have threatened internal validity. This is partially because students were exposed to different teachers and classrooms. Further, teachers may have had different levels of proficiency in delivering the literacy instruction and assessments both across teachers and within teachers across time. Third, although all participants entered the same school district, they attended separate Head Start and Kindergarten classrooms. In future research, a larger sample size targeting children from a single timeframe would allow for statistical procedures to test for potential classroom-level effects.

Fourth, future research should examine prediction of literacy skill growth in kindergarten in addition to examining outcomes at discrete time points. Although the current research study somewhat addressed prediction of growth, this exploration was limited in that growth was defined as a simple change score considering only two time points. Further, only three of the literacy variables were able to be examined through this methodology since only those three (LNF, PSF, NWF) were administered at both Mid-year and Spring. Future research with larger sample sizes would be able to, for instance, examine growth through latent variable modeling in a Structural Equation Modeling framework.

Fifth, regarding assessment and predictive validity, future research should include longitudinal investigations that examine the preschool to kindergarten period using updated versions of these literacy measures. During the time data were collected for the current study (i.e., 2005 through 2008), the first edition of the IGDIs and DIBELS (6th edition) were appropriate for use. However, DIBELS NEXT and the second edition of the IGDIs (i.e., myIGDIs) should be explicitly tested for concrete connections that support their theoretical linkages. Research in this area, specifically for those children considered Dual Language Learners, will also enhance technical adequacy information for DIBELS NEXT (or DIBELS 6th edition) measures for kindergarteners (see Ruth, Kaminski, Dewey, Wallin, Powell-Smith, &

Latimer, 2013) as school districts are still transitioning to full use of the most recent edition. Moreover, the additional tasks developed for the IGDIs (2nd edition) to assess alphabetic knowledge and comprehension (i.e., Sound Identification and “Which One Doesn’t Belong?”) may add to the measure’s ability to predict subsequent performance on DIBELS NEXT (e.g., First Sound Fluency, Oral Reading Fluency).

Sixth, although the current investigation adds to the literature base in all ways initially intended including demonstrating and testing connections between IGDIs and DIBELS, continuing to develop and validate literacy assessments for young children, addressing assessment issues for a potentially at-risk group of children, and testing for potential predictive bias based on child Primary Language Status, alternate statistical analyses may have yielded results with more practical utility. For example, with future research including larger sample size, use of logistic regression and Receiver Operating Characteristic (ROC) curve analyses would potentially yield cut-scores that relate to binary outcomes. This information would assist in identifying children at risk for reading or early literacy failure and determine classification accuracy.

Finally, as described in the previous section, Primary Language Status was determined through parent-reported primary language status through the Home Language Survey at Head Start Entry. There are several disadvantages to defining a key language variable in that way. Although assigning language group membership (PLE or PLO) using that information roughly constructs groups of students who are at least exposed to two languages with a primary language that is not English, and Dual Language Learners are acknowledged to be a diverse group (US DHHS, 2008), the resulting group is likely quite heterogeneous in terms of actual first and second language development and abilities. First and most significantly, parent-reported primary language use in the home setting does not necessarily indicate a child's ability to fluently communicate in a given language. Second, order of language acquisition does not necessarily indicate language dominance or proficiency for a DLL. Further, use of an inappropriately constructed Home Language Survey at any point can lead to misidentification of children with limited English proficiency (Bailey & Kelly, 2010). Third, since the information was gathered at Head Start entry, the time between when those data were collected and when children were assessed varied significantly across children and could have been as long as nearly two years. During that time, environments may have changed and exposure to spoken English and English literacy instruction likely affected children's language performance. Future research should enhance methodology for identifying and defining students considered to be DLLs, or have a primary or home language other than English. This can be done through use of more objective measurement and observational tools. For instance, instead of sole parent report, future studies should provide a language dominance screener to indicate whether English testing is appropriate or recommended for a child. In addition, researchers should utilize language samples or observations from classrooms as well as from home visitors.

Conclusions

In sum, analyzing the current sample only partially supported the hypothesized and previously demonstrated predictive relationship between preschool IGDI scores and DIBELS administered in kindergarten. Results also indicated that Primary Language Status neither influenced performance on literacy variables (with the exception of PN IGDI) nor moderated the predictive relationship between IGDIs and DIBELS measures in this sample. Despite results, research should continue to examine how assessment instruments function for specific groups of children and continue to test the predictive relationship between IGDIs and DIBELS in order to further develop the research base addressing measurement continuity and transition to kindergarten. This is particularly important for students who may be at greater risk for struggling academically. Moreover, extending measurement continuity to include prediction of later assessment of other critical indicators of school outcomes such as conventional reading (e.g., oral reading fluency, state reading assessments) and societal functioning such as high school graduation or job attainment will be a vital component of future measurement development.

Equally, it is critical that the research community continue to address issues of measurement development and literacy acquisition for groups of children at greater risk for later academic challenges. The current study addressed two such intersecting groups including children from families who accessed need-based preschool services (Head Start), some of whom were exposed to a language other than English in the home environment. Addressing research- and practice- related issues for these groups of children is critical to equitably furthering the fields of school psychology and child development. In addition to the general development and validation of emergent literacy measurement tools that function well for specific groups of young children, it is important for researchers to continue to test for potential predictive bias. The current study is the second to indicate that DLL status does not moderate prediction when IGDIs are included as indicators (i.e., Betts, et al., 2008; current study). Replication of this issue is certainly warranted, however, since Betts and colleagues utilized IGDIs as part of a broader assessment score, and the current study included several limitations regarding the definition of Primary Language Status (as described in a previous section).

Future research, policy, as well as assessment and intervention efforts should also begin to conceptualize working with groups that are traditionally underserved through more of a strengths-based perspective. Cultural and community strengths in addition to individual-level protective factors should be considered. Specifically for DLLs, it should be noted that exposure to and acquisition of a second language has been demonstrated to show benefits in terms of cross-language transfer of skills to the second language (e.g., Anthony, et al., 2009; Branum-Martin et al., 2006; Dickinson, et al., 2004; Lindsey, et al., 2003). In addition, cognitive benefits, particularly in executive functioning tasks, have been demonstrated in bilingual children as young as 24-months old (Puolin-Dubois, Blaye, Coutya, & Bialystok, 2011).

Similarly, when conducting literacy assessments with children who are identified as Dual Language Learners, future research- and practice-related assessment should consider language and literacy development of those children specifically. Although the NELP report provided critical information regarding the early development of reading and literacy skills for young children, it is important to recognize its limitations related to specific subgroups of children. Gutiérrez and colleagues (2010), for instance, argued that “the NELP report is yet another example of a national research synthesis that does not address the issues of prekindergarten DLLs, and . . . recommend that the report not be used as a guide for making policy for this population of children” (p. 335). Future national efforts that examine child development and have the potential power to inform policy should plan to include appropriate information for populations of children who are considered to be at–risk for later academic or developmental challenges (such as DLLs, and/or children who attend needs-based preschool programming). Extending this logic to smaller-scale research is critical to the overarching goal of obtaining appropriate information about how specific measurement and interventions function for specific groups, as obtaining this information through research syntheses and meta-analyses is impossible without appropriate reporting in individually published papers.

References

Abdullah-Welsh, N., Flaherty, J. F., Bosma, J. T. (2009). *Recommendations for future early childhood literacy research* (Technical Report). Washington, DC: National Institute for Literacy. Retrieved on February 4, 2010 from http://lincs.ed.gov/publications/pdf/ECL_Recommendation09.pdf

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Aiken, L. S. & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, CA: Sage Publications.

Al Otaiba, S., Folsom, J. S., Schatschneider, C., Wanzek, J., Greulich, L., Meadows, J., et al., *Predicting first-grade reading performance from kindergarten response to tier 1 instruction., Exceptional Children, 77,* 453-470.

Allison, P. D. (2009). Missing data. In R. E. Millsap & A. Maydeu-Olivares (Eds.), *The SAGE handbook of quantitative methods in psychology.* (72-89). Sage Publications Ltd. DOI: 10.4135/9780857020994

Allison, P. D. (2011, December). Missing data. Workshop presented through Statistical Horizons, Philadelphia, PA.

Anthony, J. L. & Fancis, D. J. (2005). Development of phonological awareness. *Current Directions in Psychological Science, 14,* 255-259.

Anthony, J. L., Solari, E. J., Williams, J. M., Schoger, K. D., & Zhang, Z. (2009). Development of bilingual phonological awareness in Spanish-speaking English Language Learners: the roles of vocabulary, letter knowledge, and prior phonological awareness. *Scientific Studies of Reading, 13,* 535-564.

Anthony, J. L., Williams, J. M., McDonals, R., & Francis, D. J. (2007). Phonological processing and emergent literacy in younger and older preschool children. *Annals of Dyslexia, 57,* 113-137.

Appl, D. J. (2000). Clarifying the preschool assessment process: Traditional practices and alternative approaches. *Early Childhood Education Journal, 27,* 219-225.

Arnold, D. H., & Doctoroff, G. L. (2003). The early education of socioeconomically disadvantaged children. *Annual Review of Psychology, 54*, 517-545.

Assessment Committee: Analysis of Reading Assessment Measures. (2002). *Dynamic Indicators of Basic Early Literacy Skills*. Retrieved May 24, 2007, from http://dibels.uoregon.edu/techreports/dibels_5th_ed.pdf

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., Tahan, K. (2011). *The Condition of Education 2011* (NCES 2011-033). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office. Retrieved on April 14, 2011 from http://nces.ed.gov/pubs2011/2011033.pdf

Bailey, A. L. & Kelly, K. R. (2010). The use and validity of Home Language Surveys in state English language proficiency assessment systems: A review and issues perspective. *Evaluating the Validity of English Language Proficiency Assessment, EVEA, edCount Center for Assessment UCLA,* Retrieved June 15, 2013 from http://www.eveaproject.com/doc/HLS%20White%20Paper%202010.pdf

Barnett, W.S., Carolan, M.E., Fitzgerald, J., & Squires, J.H. (2012). The state of preschool 2012: State preschool yearbook. New Brunswick, NJ: National Institute for Early Education Research. Retrieved on July 9, 2013 from http://nieer.org/publications/state-preschool-2012.

Beswick, J.F., & Sloat, E.A. (2006). Early literacy success: A matter of social justice. *Education Canada*, *46*, 23-26.

Betts, J., Reschly, A., Pickart, M., Heistad, D., Sheran, C., Marston, D., (2008). An examination of predictive bias for second grade reading outcomes from measures of early literacy skills in kindergarten with respect to English-Language Learners and ethnic subgroups. *School Psychology Quarterly*, *23,* 553-570.

Bialystok, E., Majumder, S., & Martin, M. (2003). Developing phonological awareness: Is there a bilingual advantage? *Applied Psycholinguistics*, *24,* 27-44, doi:10.1017/S014271640300002X

Biemiller, A. (2006). Vocabulary development and instruction: A prerequisite for school learning. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 2, pp. 41-63). New York, NY: The Guilford Press.

Branum-Martin, L., Mehta, P. D., Fletcher, J. M., Carlson, C. D., Ortiz, A., Carlo, M., et al. (2006). Bilingual phonological awareness: Multilevel construct validation among Spanish-speaking kindergarteners in transitional bilingual education classrooms. *Journal of Educational Psychology*, *98*, 170–181.

Brattle, D. E. (2009). Multiculturalism, language, and emergent literacy. In *Emergent literacy and language development: promoting learning in early childhood* (pp. 192-234). New York, NY: The Guilford Press.

Bryant, P. E., MacLean, M., Bradley, L. L., & Crossland, J. (1990). Rhyme and alliteration, phoneme detection, and learning to read. *Developmental Psychology, 26,* 429-438.

Capps, R., Fix, M., Murray, J., Ost, J., Passel, J. S., & Hernandez, S. H. (2005, September). *The new demography of America's schools: Immigration and the No Child Left Behind Act.*

Washington, DC: Urban Institute. Retrieved on April 17, 2011 from http://www.urban.org/uploadedPDF/311230_new_demography.pdf

Carta, J. J., Greenwood, C. R., Walker, D., Kaminski, R., Good, R., McConnell, S., & McEvoy, M. (2002). Individual growth and development indicators (IGDIs): Assessment that guides intervention for young children. *Young Exceptional Children Monograph Series, 4*, 15-28.

Clay, M. E. (1985). *Concepts about print.* Westport, CT: Greenwood Publishing.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Community Services for Children. (2007). *Head Start.* Retrieved from http://www.cscinc.org/parents/HeadStart.php on March 31, 2010.

Cook, R. D. and Weisberg, S. (1982). *Residuals and influence in regression*. New York: Chapman and Hall.

Cooper, D. H., Roth, F. P., Speece, D. L., & Schatschneider, C. (2002). The contribution of oral language skills to the development of phonological awareness. *Applied Psycholinguistics, 23*, 399-416.

Coyne, M. D., & Harn, B. A. (2006). Promoting beginning reading success through meaningful assessment of early literacy skills. *Psychology in the Schools, 43,* 33-43.

Cummings, K. D., Kaminski, R. A., Good, R. H., & O'Neil, M. (2011). Assessing phonemic awareness in preschool and kindergarten: development and initial validation of First Sound Fluency. *Assessment for Effective Intervention, 36,* 94-106.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33,* 934-945.

Curran, P. J., West, S. G., Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, *1*, 16-29.

De Houwer, A. (2007). Parental language input patterns and children's bilingual use. *Applied Psycholinguistics*, *28*, 411-424. doi:10.1017/S0142716407070221

Denton, K. and West, J. (2002). *Children?s Reading and Mathematics Achievement in Kindergarten and First Grade* (NCES 2002, 125). Washington, DC: National Center for Education Statistics.

Dickinson, D. K. & McCabe, A. (2001). Bringing it all together: the multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research and Practice, 16*, 186-202.

Dickinson, McCabe, & Essex (2006). A window of opportunity we must open to all: the case for preschool with high-quality support for language and literacy. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 2, pp. 11-28). New York, NY: The Guilford Press.

Douglas-Hall, A. & Chau, M. 2008. Basic Facts about Low-Income Children: Birth to Age 6. National Center for Children in Poverty, Columbia University Mailman School of Public Health. Retrieved from http://www.nccp.org/publications/pub_847.html on March 3, 2011.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody picture vocabulary test – third edition.* Circle Pines, MN: American Guidance Service.

Durán, L. K., Roseth, C. J., and Hoffman, P. (2010). An experimental study comparing English-only and transitional bilingual educationon Spanish-speaking preschoolers’ early literacy development, *Early Childhood Research Quarterly*, *25*, 207-217.

Early Childhood Research Institute on Measuring Growth and Development. (1998; 2000). *Individual Growth and Development Indicators for preschool children: Picture Naming/Expressing Meaning, Rhyming: Early Literacy, Alliteration/Early Literacy* Minneapolis, MN: Center for Early Education and Development, University of Minnesota. (Available online at www.getgotgo.net)

Early Childhood Research Institute on Measuring Growth and Development. (1998a). *Accountability systems for children between birth and age eight* (Technical Report No. 1). Minneapolis: University of Minnesota.

Early Childhood Research Institute on Measuring Growth and Development (1998b). *Selection of General Growth Outcomes for Children Between Birth and Age Eight* (Technical Report No. 2). Minneapolis, MN: University of Minnesota.

Enders, C. K. (2010). Applied missing data analysis. New York: The Guilford Press.

Estrem, T. L., & McConnell, S. R. (2008). *Monitoring Emergent Literacy Development of Immigrant Preschoolers Who Speak Somali, Spanish, or Hmong*. (Technical Report No. 9). Minneapolis: University of xxxxx. Retrieved on May 10, 2011 from http://igdis.umn.edu/about-igdis/what-are-igdis/.

Farver, J. M., Nakamoto, J., Lonigan, C. J. (2007). Assessing preschoolers' emergent literacy skills in English and Spanish with the Get Ready to Read! screening tool. Annals of Dyslexia, 57, 161-178.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Fuchs, L. S., & Deno, S. L. (1991). Paradigmatic distinctions between instructionally relevant measurement models. *Exceptional Children, 57*, 488-500.

Get It, Got It, Go! (n.d.) *Frequently Asked Questions.* Retrieved May 24, 2007, from http://ggg.umn.edu/gen_faq.html.

Gettinger, M., & Stoiber, K. (2008). Applying a response-to-intervention model for early literacy development in low-income children. *Topics in Early Childhood Special Education, 27,* 198-213.

Gischlar, K. L. (2009). *Efficiency and economy in the assessment of emergent literacy skills.* (Unpublished doctoral dissertation). Lehigh University, Bethlehem, PA.

Good, R.H., & Kaminski, R.A. (Eds.). (2002). *Dynamic Indicators of Basic Early Literacy Skills* (6th ed.). Eugene, OR: Institute for the Development of Educational Achievement. Available: http://dibels.uoregon.edu/.

Good, R. H., & Kaminski, R. A. (2011). *Dynamic Indicators of Basic Early Literacy Skills NEXT: Assessment manual.* Eugene, OR: Dynamic Measurement Group. Retrieved on July 10, 2011 from http://dibels.org/pubs.html.

Good, R. H., & Kaminski, R. A., Dewey, E. N., Wallin, J., Powell-Smith, K. A., Latimer, R. J. (2011). *Dynamic Indicators of Basic Early Literacy Skills NEXT: Technical report draft.* Eugene, OR: Dynamic Measurement Group. Retrieved on July 10, 2011 from http://dibels.org/pubs.html.

Good, R.H., Kaminski, R. A., Dewey, E. N., Wallin, J., Powell-Smith, K. A., & Latimer, R. J. (2013). *DIBELS Next* Technical Manual. Dynamic Measurement Group, Inc., Retrieved May 1, 2013 from http://dibels.org/

Good, R.H., Kaminski, R.A., Shinn, M., Bratten, J., Shinn, M., Laimon, D., Smith, S., & Flindt, N. (2004). *Technical Adequacy of DIBELS: Results of the Early Childhood Research Institute on measuring growth and development* (Technical Report, No. 7). Eugene, OR: University of Oregon.

Greenwood, C. R., Carta, J. J., & McConnell, S. (2011). Advances in measurement for universal screening and individual progress monitoring of young children. Journal of Early Intervention, 33, 254-267. DOI: 10.1177/1053815111428467

Greenwood , C. R., Luze, G.J & Carta, J. J. (2002). Best practices in assessment of intervention results with infants and toddlers. In A. Thomas, & J. Grimes (Eds), *Best Practices in School Psychology IV (pp. 1219-1230).* Bethesda , MD : National Association of School Psychologists.

Gutiérrez, K. D., Zeped, M., & Castro, D. C. (2010). Advancing early literacy learning for all children: implications of the NELP report for Dual-Language Learns. *Educational Researcher, 39*, 334-339.

Hammer, C. S., Scarpino, S., Davison, M. D. (2011). Beginning with language: Spanish-English bilingual preshoolers' early literacy development. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 3, pp. 118-135). New York, NY: The Guilford Press.

Harrell, F. (2001). *Regression modeling strategies*. NY: Springer.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul H. Brookes Publishing Co.

Hintze, J.M., Ryan, A.L., & Stoner, G. (2003). Concurrent validity and diagnostic accuracy of the Dynamic Indicators of Basic Early Literacy Skills and the Comprehensive Test of Phonological Processing. *School Psychology Review, 32,* 541-556.

Hojnoski, R. L. & Missall, K. N. (2006). Addressing school readiness: expanding school psychology in early education. *School Psychology Review, 35*, 602-614.

IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.

IBM Corp. (2010). IBM SPSS Missing Values 19. Armonk, NY: IBM Corp. Retrieved from http://support.spss.com/productsext/statistics/documentation/19/client/User%20Manuals/English/IBM%20SPSS%20Missing%20Values%2019.pdf.

Jackson, R., McCoy, A., Pistorino, C., Wilkinson, A., Burghardt, J., Clark, M., Ross C., Schochet, P., & Swank, P. *National Evaluation of Early Reading First: Final Report*, U.S. Department of Education, Institute of Education Sciences, Washington, DC: U.S. Government Printing Office, 2007.

Kazdin, A. E. (2003). Methodology: General lessons to guide research. In A. E. Kazdin (Ed.), *Methodological issues & strategies in clinical research* (3rd ed.). (pp. 877-887). Washington, DC: American Psychological Association.

Kaminski, R. A., & Good, R. H. (1996). Toward a technology for assessing basic early literacy skills. *School Psychology Review, 25*, 215-227.

Kinnear, P.R., & Gray, C.D. (2006). *SPSS 14 made simple.* New York, NY: Psychology Press Taylor and Francis Group.

LeBlanc, M. & Fitzgerald, S. (2000). Logistic regression for school psychologists. *School Psychology Quarterly, 15,* 344-358.

Lee, J., Grigg, W., and Donahue, P. (2007). *The Nation's Report Card: Reading 2007* (NCES 2007-496). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, Washington, D.C.

Leichman, E. S., Shapiro, E. S., & Caskie, G. L. (in preparation). Predictive validity of the Individual Growth and Development Indicators on the Dynamic Indicators of Basic Early Literacy Skills.

Leichman, E. S. & Shapiro, E. S. (2009, February*). Predictive validity of Individual Growth and Development Indicators.* Poster presented at the annual meeting of the National Association of School Psychologists, Boston, MA.

Lindsey, K. A., Manis, F. R., & Bailey, C. E. (2003). Prediction of first-grade reading in Sapnish-speakign English language learners. *Journal of Educational Psychology, 95,* 482-494.

Linklater, D. L., O'Connor, R. E., Palardy, G. J. (2009). Kidnergarten literacy assessment of English Only and English language learner students: An examination of the predictive validity of three phonemic awareness measures. *Journal of School Psychology, 47*, 369-394.

Lonigan, C. J. (2003). Development and promotion of emergent literacy skills in children at-risk of reading difficulties. In B. R. Foorman (Ed.), *Preventing and remediating reading difficulties: Bringing science to scale* (pp. 23-50). Baltimore: York Press.

Lonigan, C.J. (2006). Development, assessment and promotion of preliteracy skills. *Early Education and Development, 17,* 91-114.

Lonigan, C. J., Anthony, J. L., Phillips, B. M., Purpura, D. J., Wilson, S. B., & McQueen, J. D. (2009). The nature of preschool phonological processing abilities and their relations to vocabulary, general cognitive abilities, and print knowledge. *Journal of Educational Psychology*, *101*, 345-358.

Lonigan, C.J., Burgess, S.R., & Anthony, J.L. (2000). Development of emergent literacy and early reading skills in preschool children: evidence from a latent-variable longitudinal study. *Developmental Psychology, 36*, 596-613.

Lonigan, C.J., Burgess, S.R., Anthony, J.L., & Barker, T.A. (1998). Development of phonological sensitivity in 2- to 5-year old children. *Journal of Educational Psychology, 90*, 294-311.

Lonigan, C. J. & Shanahan, T. (2010). Developing early literacy skills: the things we know we know and the things we know we don't know. *Educational Researcher, 39*, 340-346.

Lonigan, C. J., Wagner, R. K., Torgesen, J. K., & Rashotte, C. A. (2007). *Test of preschool Early Literacy.* Austin, TX: Pro-Ed.

Magnuson, K., & Shager, H. (2010). Early education: progress and promise for children from low-income families. *Children and Youth Services Review, 32*, 1186-1198.

Magnuson, K., & Waldfogel, J., (2005). Early childhood care and education: effects on ethnic and racial gaps in school readiness. *The Future of Children, 15*, 169-196. Manz, P. H., Hughes, C., Barnabas, E., Bracaliello, C., & Ginsburg-Block, M., (2010). A descriptive review and meta-analysis of family-based emergent literacy interventions: To what extent is the research applicable to low-income, ethnic-minority or linguistically-diverse young children? *Early Childhood Research Quarterly*, *25*, 409-431.

Maxwell, S.E. & Delaney, H.D. (1990). *Designing Experiments and Analyzing Data.* Belmont, CA: Wadsworth Publishing Company, Wadsworth Inc.

McCardle, P., Mele-McCarthy, J., & Leos, K. (2005a). English language learners and learning disabilities: Research agenda and implications for practice. *Learning Disabilities Research & Practice, 20,* 68–78.

McConnell, S. R. (2000). Assessment in early intervention and early childhood special education: building on the past to project into our future. *Topics in Early Childhood Special Education*, *20*, 43-48.

McConnell, S., Bradfield, T., Wackerle-Hollman, A. & Rodriguez, M. (2012). Individual Growth and development Indicators of Early Literacy (IGDIs-EL), 2nd Edition; myIGDIs Early Literacy+. Saint Paul, MN: Regents of the University of Minnesota. Available online at www.myigdis.com).

McConnell, S., Bradfield, T., Wackerle-Hollman, A. & Rodriguez, M. (2013). Individual Growth and development Indicators of Early Literacy (IGDIs-EL), 2nd Edition; myIGDIs Early Literacy+. (Technical Summary Sheet). Saint Paul, MN: Regents of the University of Minnesota. Retrieved on July 9, 2013 from http://www.myigdis.com/wp-content/uploads/2013/01/IGDIs-EL-2nd-Ed-Technical-Info-Summary.pdf.

McConnell, S. R., Priest, J. S., Davis, S. D., & McEvoy, M. A. (2002). Best practices in measuring growth and development for preschool children. In A. Thomas & J. Grimes (Eds.), *Best Practices in School Psychology Best practices in school psychology: IV* (pp. 1231-1246). Bethesda, MD: National Association of School Psychologists.

McCormick, C. E. & Haack, R. (2010). Early literacy individual growth and development indicators (EL-IGDIs) as predictors of reading skills in kindergarten through second grade. *International Journal of Psychology: A Biopsychosocial Approach, 7,* 29-40.

McDowell, K. D., Lonigan, C. J., & Goldstein, H. (2007). Relations among socioeconomic status, age, and predictors of phonological awareness. *Journal of Speech, Language, and Hearing Research, 50,* 1079-1092.

Metsala, J. L. (1999). Young children's phonological awareness and nonword repetition as a function of vocabulary development. *Journal of Educational Psychology, 91*, 3-19.

Microsoft. (2010). *Microsoft Excel* [computer software]. Redmond, Washington: Microsoft.

Missall, K. N., & McConnell, S. R. (2004). *Psychometric characteristics of individual growth and development indicators: picture naming, rhyming and alliteration* (Technical Report No. 8). Minneapolis: University of Minnesota.

Missall, K. N., McConnell, S. R., & Cadigan, K. (2006). Early literacy development: skill growth and relations between classroom variables for preschool children. *Journal of Early Intervention, 29,* 1-21.

Missal, K. N., Reschly, A., Betts, J., McConnell, S., Heistad, D., Pickart, M., et al. (2007). Examination of the Predictive Validity of Preschool Early Literacy Skills. *School Psychology Review, 36*, 433-452.

National Center for Education Statistics (2009). The Nation's Report Card: Reading 2009 (NCES 2010–458). Institute of Education Sciences, U.S. Department of Education, Washington, D.C. Retrieved from http://nces.ed.gov/nationsreportcard/pdf/main2009/2010458.pdf on January 16, 2011.

National Early Literacy Panel. (2009). *Developing early literacy: Report of the National Early Literacy Panel.* Washington, DC: National Institute for Literacy.

National Education Goals Panel. (1995). *Reconsidering children's early development and learning: Toward common views and vocabulary.* Retrieved March 18, 2011 from http://www.eric.ed.gov/PDFS/ED391576.pdf

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 00-4769). Washington, DC: U.S. Government Printing Office. Retrieved October 21, 2011 from http://www.nationalreadingpanel.org/Publications/publications.htm.

National Research Council. (2008). *Early Childhood Assessment: Why, What, and How?* Committee on Developmental Outcomes and Assessments for Young Children, In C. E. Snow & S. B. Van Hemel, (Eds.). Board on Children, Youth and Families, Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press. Retrieved on March 18, 2011 from http://www.acf.hhs.gov/programs/opre/hs/national_academy/reports/early_child_assess/early_child_assess.pdf.

Neuman, S. B., (2006). The knowledge gap: implications for early education. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 2, pp. 29-40). New York, NY: The Guilford Press.

Neuman, S. B., & Roskos, K. (2005). The state of state pre-kindergarten standards. *Early Childhood Research Quarterly, 20,* 125-145.

O'Connor, R. E., & Jenkins, J. R. (1999). Prediction of reading disabilities in kindergarten and first grade. *Scientific Studies of Reading, 3,* 159-197.

Páez, M. M., Tabors, P. O., López, L. M. (2007). Dual language and literacy development of Spanish-speaking preschool children. *Journal of applied developmental psychology, 28,* 85-102.

Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. Child development, 76, 763-782.

Phaneuf, R. L. & Silberglitt, B. (2003). Tracking preschoolers' language and preliteracy development using a general outcome measurement system: one education district's experience. *Topics in Early Childhood Special Education, 23*, 114-123.

Peng, C. J., Lee, K. L., & Ingersoll, G. M. (2002). An introduction to logistic regression analysis and reporting. *The Journal of Educational Research, 96,* 3-14.

Phillips, B. M., Clancy-Menchetti, J., Lonigan, C. J. (2008). Successful phonological awareness instruction with preschool children: Lessons from the classroom. *Topics in Early Childhood Special Education, 28,* 3-17.

Puolin-Dubois, D., Blaye, A., Coutya, J., & Bialystok, E. (2011). The effects of bilingualism on toddlers' executive functioning. *Journal of Experimental Child Psychology, 108,* 567-579. doi:10.1016/j.jecp.2010.10.009

Pressimone, V. J. (2011). *Caregiver-reports and direct observations of language interactions in the Latino, bilingual home.* Poster presented at the annual meeting of the National Association of School Psychologists, San Francisco, MA.

Roseth, C. J., Missall, K. N., & McConnell, S. R. (2012). Early literacy individual growth and development indicators (EL-IGDIs): Growth trajectories using a large internet-based sample. Journal of School Psychology, 50, 483-501. DOI: 10.1016/j.jsp.2012.03.001

Scarborough, H. S. & Brady, S. A. (2002). Toward a common terminology for talking about speech and reading: A glossary of the “phon” words and some related terms. *Journal of Literacy Research, 34*, 299-336.

Schatschneider, C. Fletcher, J. M., Francis, D. J., Carlson, C. D., Foorman, B. R. (2004). Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology, 96*, 265-282.

Shanahan, T. & Lonigan, C. J. (2010). The National Early Literacy Panel: a summary of the process and the report. *Educational Researcher, 39,* 279-285.

Snow C. E., Burns S. M., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington DC: National Academy Press.

Snow, C.E., Porche, M.V., Tabors, P.O., & Harris, S.R. (2007). *Is literacy enough? Pathways to academic success for adolescents.* Baltimore, MD: Paul H. Brookes.

Spira, E. G., Bracken, S. S., & Fischel, J. E. (2005). Predicting improvements after first grade reading difficulties: The effects of oral language, emergent literacy, and behavior skills. *Developmental Psychology, 41,* 225-234.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360- 406.

Stevens, J. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Stevens, J. P. (2009). *Applied multivariate statistics for the social sciences* (5^{th} ed.). New York: Routledge, Taylor & Francis Group.

Storch, S. A. & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: evidence from a longitudinal structural model. *Developmental Psychology, 38,* 934-947.

Strickland, D. S. (2005). Literacies in early childhood: the interface of policy, research, and practice. In N. Bascia, A. Cumming, A. Datnow, K. Leithwood, & D. Livingstone (Eds.), *International Handbook of Educational Policy* (pp. 629-644). Great Britain: Springer.

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston: Pearson.

Tabors, P. O. & Snow, C. E. (2002). Young bilingual children and early literacy development. In D. K. Dickinson & S. B. Neuman (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 159-178). New York, NY: The Guilford Press.

Teale, W.H. & Sulzby, E. (Eds.). (1986). *Emergent literacy: writing and reading.* Norwood: Ablex Publishing Corporation.

Todd, M. F. (2010). *Literacy and behavior in early childhood: Exploring the factors that impact achievement.* (Unpublished doctoral dissertation).University of South Florida, Tampa, Florida.

Torgeson, J. K. & Bryant, B. R. (1994). *Test of phonological awareness*. Austin, TX: Pro-ed.

Tukey J. W. (1962). The future of data analysis. *The Annals of Mathematical Statistics, 33*, 1-67. doi: 10.1214/aoms/1177704711

U. S. Department of Education. (n.d.). Early Reading First Program Description, CFDA Number: 84.359A; 84.359B. Retrieved from http://www2.ed.gov/programs/earlyreading/index.html on March 30, 2010.

U. S. Department of Education. (2007). *National Evaluation of Early Reading First. NCEE 2007-4007*. Retrieved October 15, 2008, from http://ies.ed.gov/ncee/pdf/20074007_execsumm.pdf.

U.S. Department of Education. (2001). No child left behind. Retrieved March 15, 2010, from http://www.ed.gove/nclb

U. S. Department of Education. (2008). *Reading First Impact Study: Interim Report. NCEE 2008-4016*. Retrieved October 15, 2008, from http://ies.ed.gov/ncee/pdf/20084016.pdf. U.S. Department of Education, Office of Elementary and Secondary Education. (2006). *Reading first state annual performance report data 2002-2006*. Retrieved July 15, 2007, from http://www.ed.gov/programs/readingfirst/state-data/achievement-data.pdf

U.S. Department of Health and Human Services, Administration for Children and Families. (2008) Dual language learning: what does it take? Early Childhood Learning and Knowledge Center, Office of Head Start. Contract No. 233-02-0002. Retrieved on March 21, 2011 from http://eclkc.ohs.acf.hhs.gov/hslc/tta-system/teaching/eecd/Individualization/ Learning%20in%20Two%20Languages/ DLANA_final_2009%5B1%5D.pdf.

U.S. Department of Health and Human Services, Administration for Children and Families (January 2010). Head Start Impact Study. Final Report. Washington, DC. Retrieved March 15, 2011 from http://www.acf.hhs.gov/programs/opre/hs/impact_study/.

U.S. Department of Health and Human Services, Administration for Children and Families (April 2013*). Report to Congress on Dual Language Learners in Head Start and Early Head Start Programs*. Washington, DC. Retrieved June 15, 2013 from http://www.acf.hhs.gov/programs/opre/resource/report-to-congress-on-dual-language-learners-in-head-start-and-early-head.

VanDerHeyden, A. M., Snyder, P. A., Broussard, C., & Ramsdell, K. (2008). Measuring response to early literacy intervention with preschoolers at risk. *Topics in Early Childhood Special Education, 27,* 232-249.

von Hippel, P. T. (2007). Regression with missing Ys: An improved strategy for analyzing multiply imputed data. *Sociological Methodology, 37*, 83-117.

Wagner, R.K., Torgesen, J.K., & Rashotte, C.A. (1994). Development of reading-related phonological processing abilities: new evidence of bidirectional causality from a latent variable longitudinal study. *Developmental Psychology, 30*, 73-87.

Wagner, R.K., Torgesen, J.K., & Rashotte, C.A. (1999). Comprehensive Test of Phonological Processing. Austin, TX: PRO-ED, Inc.

Wagner, R.K., Torgesen, J.K., Rashotte, C.A., Hecht, Barker, T.A., Burgess, S.R., et al. (1997). Changing relations between phonological processing abilities and word level reading as children develop from beginning to skilled readers: a 5-year longitudinal study. *Developmental Psychology, 33,* 468-479.

Whitehurst, G. J. & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development*, *68,* 848-872.

Whitehurst, G. J. & Lonigan, C. J. (2001). *Get Ready to Read! Screening tool.* New York: national Center for Learning Disabilities.

Wilson, S. B. & Lonigan, C. J. (2009). An evaluation of two emergent literacy screening tools for preschool children. *Annals of Dyslexia*, *59,* 115-131.

Wilson, S. B. & Lonigan, C. J. (2010). Identifying preschool children at risk of later reading difficulties: evaluation of two emergent literacy screening tools. *Journal of Learning Disabilities, 43*, 62-76.

Yesil-Dagli, U. (2011). Predicting ELL students' beginning first grade English oral reading fluency from initial kindergarten vocabulary, letter naming, and phonological awareness skills. *Early Childhood Research Quarterly, 26*, 15-29.

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (1992). *Preschool language scales – third edition. San Antonio*, TX: The Psychological Corporation.

Table 1

Preliminary Demographic Information

	Year		Sample		Gender (% Female of cohort)	Age (months) at Kindergarten Entry	Primary Language Status (Parent report)			
	Spring of Pre-school	Kindergarten	*n*	% sample		Mean	English		Dual Language Learner	
							n	%	*n*	%
Cohort 1	2006	2006-2007	25	26.6	44.0	64.4	17	68.0	8	32.0
Cohort 2	2007	2007-2008	34	36.2	50.0	64.8	19	55.9	15	44.1
Cohort 3	2008	2008-2009	35	37.2	48.6	65.9	21	60.0	14	40.0
Total	--	--	94	--	47.9	65.1	57	60.6	37	39.4

Table 2

Participant Assessment Schedule

	Spring Pre-Kindergarten Emergent Literacy	**Fall Kindergarten**	**Mid-Year Kindergarten**	**Spring Kindergarten**
IGDI	Picture Naming	-----	-----	-----
(predictive measure)	Rhyming	-----	-----	-----
	Alliteration	-----	-----	-----
DIBELS Fluency	-----	Initial Sound*	Initial Sound*	-----
	-----	Letter Naming	Letter Naming	Letter Naming
(criterion measure)	-----	-----	Phoneme Segmentation	Phoneme Segmentation
	-----	-----	Nonsense Word	Nonsense Word

Note: *Initial Sound Fluency administered to Cohorts 2 and 3 only.

Table 3

Complete Data

	n
Complete IGDI set (PN, RH, AL)	86
Combinations for Predictions	
IGDI & Fall ISF	58
IGDI & Fall LNF	75
IGDI & MidYear ISF	57
IGDI & MidYear LNF, PSF, NWF	71
IGDI & Spring LNF, PSF, NWF	71
FALL – Kindergarten	
ISF	63
LNF	82
MidYear - Kindergarten	
ISF	62
LNF, PSF, & NWF	78
Spring – Kindergarten	
LNF, PSF, NWF	78

Note: IGDI – Individual Growth and Development Indicators; ISF – Initial Sound Fluency; PSF – Phoneme Segmentation Fluency; NWF - Nonsense Word Fluency

Table 4

Descriptive Statistics: Full Sample

Variable	***N***	**Mean**	**SD**	**Range**	**Skewness**	**Kurtosis**
EL-IGDI						
Picture Naming	89	22.43	7.07	6-38	-0.23	-0.54
Rhyming	87	9.64	7.05	0-27	0.41	-0.66
Alliteration	87	4.80	4.76	0-17	0.96	0.25
Fall DIBELS						
ISF	63	9.33	8.13	0-37	0.98	0.93
LNF	82	19.05	14.92	0-61	0.55	-0.30
Mid-Year DIBELS						
ISF	62	16.21	8.41	0-38	0.21	-0.18
LNF	82	30.61	16.39	0-72	-0.08	-0.76
PSF	82	16.20	14.92	0-54	0.79	-0.43
NWF	85	13.58	14.10	0-81	1.75	5.31
w_NWF	85	13.31	12.96	0-58	1.09	1.16
Spring DIBELS						
LNF	81	42.19	20.26	0-100	0.34	0.40
PSF	83	34.67	18.50	0-64	-0.51	-0.91
NWF	81	32.32	26.42	0-155	2.42	8.86
w_NWF	81	29.91	18.23	0-70	0.38	-0.19
Mid-Year to Spring DIBELS Δ scores						
LNF	79	11.27	14.01	-12 – 65	1.09	2.15
PSF	79	19.14	15.51	-11 – 51	0.06	-0.83
NWF	79	18.38	20.28	-17 – 121	2.19	8.56
w_NWF	79	17.71	17.50	-17 - 74	1.15	2.43

Note: ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; w_NWF = Winsorized

Table 5

Descriptive Statistics: Primary Language English

Variable	***N***	**Mean**	**SD**	**Range**	**Skewness**	**Kurtosis**
EL-IGDI						
Picture Naming	53	24.09	6.37	11-38	-0.09	-0.67
Rhyming	52	9.27	7.63	0-27	0.60	-0.48
Alliteration	51	5.22	4.86	0-17	0.72	-0.32
Fall DIBELS						
ISF	38	9.24	7.20	0-27	0.55	-0.40
LNF	51	20.18	15.14	0-61	0.59	-0.05
Mid-Year DIBELS						
ISF	38	15.55	8.07	0-31	0.09	-0.51
LNF	54	32.07	16.45	0-72	-0.01	-0.59
PSF	53	16.32	15.25	0-54	0.92	-0.18
NWF	53	11.98	11.17	0-49	1.02	1.07
w_NWF	53	11.98	11.17	0-49	1.02	1.07
Spring DIBELS						
LNF	52	42.29	20.03	2-100	0.66	0.74
PSF	51	34.98	18.42	0-62	-0.53	-0.80
NWF	52	30.23	24.85	0-145	2.45	9.15
w_NWF	52	28.12	17.53	0-70	0.54	0.16

Note: ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; w_NWF = Winsorized NWF;

Table 6

Descriptive Statistics: Primary Language Other

Variable	***N***	**Mean**	**SD**	**Range**	**Skewness**	**Kurtosis**
EL-IGDI						
Picture Naming	36	19.97	7.41	6-33	-0.13	-0.82
Rhyming	35	10.20	6.14	0-21	0.04	-1.28
Alliteration	36	4.22	4.61	0-17	1.40	1.85
Fall DIBELS						
ISF	25	9.48	9.53	0-37	1.27	0.48
LNF	31	17.19	14.60	0-48	1.45	-0.78
Mid-Year DIBELS						
ISF	24	17.25	9.01	0-38	0.30	0.21
LNF	28	27.79	16.17	0-51	-0.28	-1.36
PSF	29	15.97	14.56	0-47	0.55	-0.93
NWF	32	16.22	17.83	0-81	1.73	4.39
w_NWF	32	15.50	15.43	0-58	0.95	0.53
Spring DIBELS						
LNF	29	42.00	21.01	0-84	-0.16	0.08
PSF	32	34.19	18.90	1-64	-0.50	-1.02
NWF	29	36.07	29.09	0-155	2.45	9.53
w_NWF	29	33.14	19.33	0-70	0.11	-0.34

Note: ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; w_NWF = Winsorized NWF

Table 7

Correlations Between Pre-kindergarten Registration IGDIs and Kindergarten DIBELS (all)

			Head Start Spring IGDIs			**Fall (F) DIBELS**		**Mid-Year (MY) DIBELS**				**Spring(S) DIBELS**		
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
IGDIs	**1**	**IGDI – PN** **(*n*)**	1											
	2	**IGDI – RH** **(*n*)**	.297** (87)	1										
	3	**IGDI – AL** **(*n*)**	.311** (87)	.438*** (86)	1									
F DIBELS	**4**	**F_ISF** **(*n*)**	-.048 (59)	.140 (58)	.229ǂ (58)	1								
	5	**F_LNF** **(*n*)**	.228* (78)	.086 (76)	.125 (76)	.408** (61)	1							
MY DIBELS	**6**	**MY_ISF** **(*n*)**	.039 (58)	.023 (57)	.012 (57)	.554*** (62)	.452*** (60)	1						
	7	**MY_LNF** **(*n*)**	.299** (77)	.195ǂ (76)	.288* (76)	.485*** (60)	.774*** (79)	.473*** (60)	1					
	8	**MY_PSF** **(*n*)**	.397*** (77)	.210ǂ (76)	.274* (75)	.347** (59)	.524*** (78)	.437** (59)	.577*** (80)	1				
	9	**MY_w_NWF** **(*n*)**	.039 (80)	.078 (78)	.111 (78)	.525*** (60)	.600*** (79)	.545*** (60)	.646*** (80)	.583*** (80)	1			
S DIBELS	**10**	**S_LNF** **(*n*)**	.232 * (77)	.197ǂ (75)	.051 (75)	.320* (59)	.634*** (78)	.448*** (59)	.713*** (79)	.381** (79)	.526*** (79)	1		
	11	**S_PSF** **(*n*)**	.372 ** (79)	.128 (77)	.039 (77)	.169 (60)	.339** (78)	.502*** (60)	.361** (78)	.568** (79)	.321** (81)	.466*** (80)	1	
	12	**S_w_NWF** **(*n*)**	.171 (77)	.099 (75)	.012 (75)	.294* (59)	.539*** (78)	.463*** (59)	.610*** (78)	.450*** (78)	.640*** (79)	.773*** (79)	.539*** (80)	1

Note: PN = Picture Naming; RH = Rhyming; AL = Alliteration; ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; w_NWF = Winsorized Nonsense Word Fluency

ǂ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 8

Correlations Between Pre-kindergarten Registration IGDIs and Kindergarten DIBELS (PLE)

			Head Start Spring IGDIs			Fall (F) DIBELS		Mid-Year (MY) DIBELS				Spring(S) DIBELS		
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
IGDIs	**1**	**IGDI – PN** **(*n*)**	1											
	2	**IGDI – RH** **(*n*)**	.356** (52)	1										
	3	**IGDI – AL** **(*n*)**	.445** (51)	.662*** (51)	1									
F DIBELS	**4**	**F_ISF** **(*n*)**	-.026 (35)	.179 (34)	.201 (34)	1								
	5	**F_LNF** **(*n*)**	.121 (48)	.194 (47)	.042 (46)	.439** (38)	1							
MY DIBELS	**6**	**MY_ISF** **(*n*)**	-.128 (35)	-.057 (34)	-.214 (34)	.683*** (38)	.557*** (38)	1						
	7	**MY_LNF** **(*n*)**	.276ǂ (50)	.290* (49)	.222 (48)	.374* (38)	.747*** (51)	.458** (38)	1					
	8	**MY_PSF** **(*n*)**	.440** (49)	.284ǂ (48)	.410** (47)	.358* (37)	.506*** (50)	.460** (37)	.561*** (53)	1				
	9	**MY_w_NWF** **(*n*)**	.223 (49)	.212 (48)	.074 (47)	.397* (37)	.631*** (50)	.629*** (37)	.651*** (53)	.544*** (52)	1			
S DIBELS	**10**	**S_LNF** **(*n*)**	.180 (49)	.157 (48)	-.032 (47)	.208 (38)	.718*** (50)	.448** (38)	.798*** (79)	.315* (51)	.575*** (51)	1		
	11	**S_PSF** **(*n*)**	.344ǂ (48)	.121 (47)	-.006 (46)	.172 (37)	.381** (49)	.514** (37)	.380** (52)	.579*** (51)	.450** (50)	.387** (51)	1	
	12	**S_w_NWF** **(*n*)**	.302* (49)	-.129 (48)	-.065 (47)	.264 (38)	.598** (50)	.536** (38)	.676*** (52)	.431** (51)	.582*** (51)	.779*** (52)	.532*** (51)	1

Note: PN = Picture Naming; RH = Rhyming; AL = Alliteration; ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; w_NWF = Winsorized Nonsense Word Fluency

ǂ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 9

Correlations Between Pre-kindergarten Registration IGDIs and Kindergarten DIBELS (PLO)

			Head Start Spring IGDIs			**Fall (F) DIBELS**		**Mid-Year (MY) DIBELS**				**Spring(S) DIBELS**		
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
IGDIs	**1**	**IGDI – PN** ***(n)***	1											
	2	**IGDI – RH** ***(n)***	.285ǂ (35)	1										
	3	**IGDI – AL** ***(n)***	.103 (36)	.042 (35)	1									
F DIBELS	**4**	**F_ISF** ***(n)***	-.131 (24)	.119 (24)	.279 (24)	1								
	5	**F_LNF** ***(n)***	.341ǂ (30)	-.103 (29)	.238 (30)	.424* (23)	1							
MY DIBELS	**6**	**MY_ISF** ***(n)***	.295 (23)	.155 (23)	.391ǂ (23)	.421* (24)	.340 (22)	1						
	7	**MY_LNF** ***(n)***	.256 (27)	.053 (27)	.364ǂ (27)	.680*** (22)	.838*** (28)	.587** (22)	1					
	8	**MY_PSF** ***(n)***	.375* (28)	.060 (28)	.015 (28)	.345 (22)	.589** (28)	.412ǂ (22)	.620** (27)	1				
	9	**MY_w_NWF** ***(n)***	-.055 (31)	-.130 (30)	.208 (31)	.646** (23)	.693*** (29)	.442* (23)	.721*** (27)	.668*** (28)	1			
S DIBELS	**10**	**S_LNF** ***(n)***	.345ǂ (28)	.296 (27)	.201 (28)	.486* (21)	.536** (28)	.441* (21)	.568** (27)	.535** (26)	.482** (28)	1		
	11	**S_PSF** ***(n)***	.453* (31)	.142 (30)	.111 (31)	.175 (23)	.288 (29)	.511* (23)	.362ǂ (27)	.552** (28)	.201 (31)	.607*** (29)	1	
	12	**S_w_NWF** ***(n)***	.144 (28)	.005 (27)	.204 (28)	.329 (21)	.557** (28)	.339 (21)	.564** (26)	.517** (27)	.705*** (28)	.772*** (27)	.558** (29)	1

Note: PN = Picture Naming; RH = Rhyming; AL = Alliteration; ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; w_NWF = Winsorized Nonsense Word Fluency

ǂ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 10

Test of Dependent Correlations: Comparison across IGDIs (all)

		Comparisons (*z*-scores)		
		PN-RH	***PN-AL***	***RH-AL***
Initial Sound Fluency	F ISF	***-1.97****	***-2.66*****	-0.77
		PN<RH	***PN<AL***	--
	MY ISF	0.21	0.32	0.11
		--	--	--
Letter Naming Fluency	**F LNF**	1.44	1.03	-0.42
		--	--	--
	MY LNF	1.00	0.11	-0.90
		--	--	--
	S LNF	0.34	1.86	1.53
		--	--	--
Phoneme Segmentation Fluency	**MY PSF**	1.81	1.19	-0.62
		--	--	--
	S PSF	***2.40****	***3.34******	1.00
		PN>RH	***PN>AL***	--
Nonsense Word Fluency	**MY w_NWF**	-0.46	-0.83	-0.37
		--	--	--
	S w_NWF	0.74	1.75	1.02
		--	--	--

Note: PN = Picture Naming; RH = Rhyming; AL = Alliteration; ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; w_NWF = Winsorized Nonsense Word Fluency; F = Fall; MY = Midyear; S = Spring
* $p < .05$; ** $p < .01$; *** $p < .001$

Table 11

Multiple Regression Models Predicting Individual DIBELS Variables

Simultaneous Predictors		b	*SE*	ß	*t*	*P*	R^2
Fall ISF	Constant	11.14	4.82		2.31	>.05	
	Overall Model					.29	.07
	IGDI-PN	-.17	.20	-.12	-.88	.39	
	IGDI-RH	.03	.16	.03	.17	.86	
	IGDI-AL	.46	.28	.26	1.62	.11	
Fall LNF	Constant	8.83	6.02		1.47	.147	
	Overall Model					.29	.05
	IGDI-PN	.42	.26	.19	1.58	.12	
	IGDI-RH	-.01	.26	-.01	-.02	.99	
	IGDI-AL	.25	.41	.08	.61	.54	
Mid-year ISF	Constant	13.88	5.28		2.63	>.05	
	Overall Model					.98	.01
	IGDI-PN	.10	.22	.07	.45	.65	
	IGDI-RH	.03	.18	.03	.16	.87	
	IGDI-AL	-.05	.31	-.03	-.15	.88	

Table 12

Multivariate Multiple Linear Regressions at Mid-Year and Spring

Outcome Measures

Predictive Measures		***Mid-Year DIBELS***			***Spring DIBELS***		
		LNF	**PSF**	**w_NWF**	**LNF**	**PSF**	**w_NWF**
		n = 71			n = 71		
PN-IGDI RH-IGDI AL-IGDI	*Wilks' Λ*	.72** F(9, 158.34) = 2.55			.84 F(9, 158.34) = 1.26		
	R^2	.15*	.18**	.03	---	---	---
PN-IGDI	*β*	.25*	.33**	.07	---	---	---
	b	.64*	.73**				
RH-IGDI	*β*	.00	.04	.07	---	---	---
AL-IGDI	*β*	.22	.15	.09	---	---	---

* $p < .05$
** $p < .01$
*** $p < .001$

Note. PN-IGDI = Picture Naming IGDI; RH-IGDI = Rhyming IGDI; AL-IGDI = Alliteration IGDI; Data are not presented when Wilks' test was statistically non-significant

Table 13

Multivariate Multiple Linear Regressions for Change Scores

Outcome Measures

Predictive Measures		***Mid-Year to Spring Growth***		
		ΔLNF	**ΔPSF**	**Δw_NWF**
		n = 68		
PN-IGDI RH-IGDI AL-IGDI	*Wilks' Λ*	.80 $F(9, 151.04) = 1.63$		
	R^2	---	---	---
PN-IGDI	*β*	---	---	---
RH-IGDI	*β*	---	---	---
AL-IGDI	*β*	---	---	---

* *p* < .05
** *p* < .01
*** *p* < .001

Note. PN-IGDI = Picture Naming IGDI; RH-IGDI = Rhyming IGDI; AL-IGDI = Alliteration IGDI; ΔLNF = change in Letter Naming Fluency from Mid-year to Spring; ΔPSF = change in Phoneme Segmentation Fluency Mid-year to Spring; Δw_NWF = change in Winsorized Nonsense Word Fluency; Data are not presented when Wilks' test was statistically non-significant

Table 14

Differences on Literacy Scores based on Primary Language Status

Dependent Variables	Wilks' Lambda	*F*	*df*	*df* error	*Mean PLE	*Mean PLO
Spring IGDIs (overall model)	0.90	2.92*	3	82		
PN	--	6.27*	1	84	24.06	19.97
RH	--	.28	1	84	--	--
AL	--	.99	1	84	--	--
Fall DIBELS						
ISF	--	.01	1	61	--	--
LNF	--	.77	1	80	--	--
MY DIBELS						
ISF	--	.60	1	60	--	--
LNF, PSF, NWF (overall model)	.94	1.54	3	74	--	--
Spring DIBELS						
LNF, PSF, NWF (overall model)	.97	.59	3	74	--	--

Note: PN = Picture Naming; RH = Rhyming; AL = Alliteration; ISF = Initial Sound Fluency; LNF = Letter Naming Fluency; PSF = Phoneme Segmentation Fluency; NWF = Nonsense Word Fluency; F = Fall; MY = Midyear; S = Spring
* $p < .05$; ** $p < .01$; *** $p < .001$; *Group means provided for statistically significant findings

Table 15

Hierarchical Regression Predicting Fall ISF

Model	Predictor	b	β	R^2	ΔR^2	F	p
			(n = 58)				
Model 1				0.067		.958	0.439
	PLS	-.381	-.024				
	PN-IGDI	-.176	-.199				
	RH-IGDI	.036	.171				
	AL-IGDI	.445	.290				
Model 2				0.088	0.021	.691	0.679
	PLS	.638	.040			*Sig* ΔF = .381	
	PN-IGDI	-.030	.284				
	RH-IGDI	.071	.066				
	AL-IGDI	.222	.127				
	PLS x cPN	-.299	-.144				
	PLS x cRH	-.033	-.016				
	PLS x cAL	.549	.182				

* $p <$ .05
** $p <$ .01
*** $p <$ .001

Note. PLS = Primary Language Status; cPN-IGDI, cRH-IGDI, cAL-IGDI = centered IGDIs; LNF, PSF, NWF – Kindergarten DIBELS measures;

Table 16

Hierarchical Regression Predicting Fall LNF

Model	Predictor	b	β	R^2	ΔR^2	F	p
			(n = 75)				
Model 1				0.052		.953	0.439
	PLS	-.449	-.015				
	cPN-IGDI	.406	.188				
	cRH-IGDI	.001	.001				
	cAL-IGDI	.244	.078				
Model 2				0.105	0.053	1.119	0.362
	PLS	.413	.014			*Sig* ΔF = .274	
	PN-IGDI	.310	.144				
	RH-IGDI	.469	.365				
	AL-IGDI	-.533	-.169				
	PLS x cPN	.315	.098				
	PLS x cRH	-.816	-.224				
	PLS x cAL	1.340	.251				

* $p < .05$
** $p < .01$
*** $p < .001$

Note. PLS = Primary Language Status; cPN-IGDI, cRH-IGDI, cAL-IGDI = centered IGDIs; LNF, PSF, NWF – Kindergarten DIBELS measures;

Table 17

Hierarchical Regression Predicting Mid-year ISF

Model	Predictor	b	β	R^2	ΔR^2	F	p
			(n = 57)				
Model 1				0.008		.111	0.978
	PLS	1.180	.070				
	cPN-IGDI	.119	.081				
	cRH-IGDI	-.002	-.001				
	cAL-IGDI	-.012	-.007				
Model 2				0.126	0.117	1.005	0.439
	PLS	1.698	.101			*Sig* ΔF = .101	
	cPN-IGDI	-.043	-.029				
	cRH-IGDI	.145	.127				
	cAL-IGDI	-.489	-.268				
	PLS x cPN	.374	.161				
	PLS x cRH	-.028	-.012				
	PLS x cAL	1.207	.384				

Table 18

Hierarchical Multivariate Multiple Linear Regressions at Mid-Year

Outcome Measures							
Predictive Measures		**Mid-Year DIBELS**			**Model Change**		
		LNF	**PSF**	**NWF**	**LNF**	**PSF**	**NWF**
		n = 71			Model Change Statistics for Significant Predictions		
Model 1	*Wilks' Λ*	.685* $F(12, 169.62) = 2.17$					
PLS cPN-IGDI cRH-IGDI cAL-IGDI	R^2	.17*	.19**	.03	---	---	---
PLS	*β*	-.13	.08	-.01			
cPN-IGDI	*β*	.21	.36*	.13	---	---	---
cRH-IGDI	*β*	.03	.02	.11	---	---	---
cAL-IGDI	*β*	.20	.16	.22	---	---	---
Model 2	*Wilks' Λ*	.559* $F(21, 175.71) = 1.88$			Δ *Wilks' Λ* = .816 *Rao's R* = 2.353*		
PLS cPN-IGDI cRH-IGDI cAL-IGDI PLS x cPN PLS x cRH PLS x cAL	R^2	.21*	.21*	.11	$\Delta R^2 = .04$	$\Delta R^2 = .02$	---
					$F(3, 63) = 1.063$ $p = .371$	$F(3, 63) = .531$ $p = .662$	---
PLS	*β*	-.11	.08	.02			
cPN-IGDI	*β*	.28	.36*	.24			
cRH-IGDI	*β*	.23	-.01	.31			
cAL-IGDI	*β*	-.04	.27	-.21			
PLS x cPN	*β*	-.05	-.01	-.17			
PLS x cRH	*β*	-.18	-.04	-.26			
PLS x cAL	*β*	.23	-.18	.25			

* $p < .05$
** $p < .01$
*** $p < .001$

Note. PLS = Primary Language Status; cPN-IGDI, cRH-IGDI, cAL-IGDI = centered IGDIs; LNF, PSF, NWF – Kindergarten DIBELS measures; Rao's R significance based on F distribution; Data are not presented when Wilks' test was statistically non-significant

Table 19

Hierarchical Multivariate Multiple Linear Regressions at Spring

Predictive Measures		**Outcome Measures**: **Mid-Year DIBELS**			**Model Change**		
		LNF	**PSF**	**NWF**	**LNF**	**PSF**	**NWF**
		n = 71			Model Change Statistics (Multivariate only)		
Model 1	*Wilks' Λ*	.793 $F(12, 169.62) = 1.29$					
PLS **cPN-IGDI** **cRH-IGDI** **cAL-IGDI**	R^2	---	---	---	---	---	---
PLS	*β*	---	---	---			
cPN-IGDI	*β*	---	---	---	---	---	---
cRH-IGDI	*β*	---	---	---	---	---	---
cAL-IGDI	*β*	---	---	---	---	---	---
Model 2	*Wilks' Λ*	.672 $F(21, 175.71) = 1.24$			Δ *Wilks' Λ* = .847		
PLS **cPN-IGDI** **cRH-IGDI** **cAL-IGDI** **PLS x cPN** **PLS x cRH** **PLS x cAL**	R^2	---	---	---	*Rao's R* = 1.898 $p = .085$		
PLS	*β*	---	---	---			
cPN-IGDI	*β*	---	---	---			
cRH-IGDI	*β*	---	---	---			
cAL-IGDI	*β*	---	---	---			
PLS x cPN	*β*	---	---	---			
PLS x cRH	*β*	---	---	---			
PLS x cAL	*β*	---	---	---			

* $p < .05$
** $p < .01$
*** $p < .001$

Note. PLS = Primary Language Status; cPN-IGDI, cRH-IGDI, cAL-IGDI = centered IGDIs; LNF, PSF, NWF – Kindergarten DIBELS measures; Rao's R significance based on F distribution; Data are not presented when Wilks' test was statistically non-significant

Figure 1. Formula used to compare Wilks' Lambdas

Note: Formula used to compare multivariate models when hierarchical regression was employed J. G. Lutz, personal electronic communication, March 6, 2012

$$\Lambda_{p7\ vs.\ p4} = \frac{\left|\Lambda_{p7\ vs.\ null}\right|}{\left|\Lambda_{p4\ vs.\ null}\right|} = \frac{\left\{\dfrac{\left|S_{ep7}\right|}{\left|S_{e0}\right|}\right\}}{\left\{\dfrac{\left|S_{ep4}\right|}{\left|S_{e0}\right|}\right\}} = \frac{\left|S_{ep7}\right|}{\left|S_{ep4}\right|}$$

Definition:
Λ = Wilks' Λ
p = # predictors
Se = model error matrix

Figure 2. Formula used to derive Rao (Stevens, 2002)

$$\left[\frac{\left(1-\lambda^{\frac{1}{s}}\right)}{\lambda^{\frac{1}{s}}}\right]\left[\frac{\left(ms-\frac{p(k-1)}{2}+1\right)}{\left(p(k-1)\right)}\right]$$

Definition:
Λ = Wilks' Λ
N = total sample
p = number of dependent variables
k = "groups" in a MANOVA context; number of rows in the hypothesis matrix; number of steps/parameters (betas) between the two models (e.g., null *vs*. full, step 1 *vs*. full, etc.)
m = N - 1 - (p + k)/2

$$s = \sqrt{\frac{\left(p^2\left(k-1\right)^2-4\right)}{\left(p^2+(k-1)^2-5\right)}}$$

Figure 3. Formula used to determine *F* test and significance of ΔR^2 in multivariate regression models (Maxwell & Delaney, 1990)

$$\mathrm{F} = \frac{\left[\left(1-R^2(reduced)\right) - \frac{\left(1-R^2(full)\right)}{denomninator\ DFreduced - denominator\ DFfull}\right]}{\left[\frac{\left(\left(1-R^2(full)\right)\right)}{DFfull}\right]}$$

Definition:
DF = degrees of freedom
Significance of *F* determined through Microsoft Excel

Erin S. Leichman

College of Education
Lehigh University
(610) 758-3225

Education

July 2012 – July 2013	**Pre-Doctoral Internship, Psychology** Louisiana State University Health Sciences Center American Psychological Association (APA) Accredited
Aug 2006 – Aug 2013	**Doctoral Candidate, School Psychology** **Specialization in Health & Pediatric School Psychology** Lehigh University, Bethlehem, PA Graduate GPA: 3.96 APA accredited and NASP approved Dissertation: Predictive validity of the Individual Growth and Development Indicators in a sample of children who attend Head Start Advisor**:** Edward S. Shapiro, Ph.D. Committee Members: Grace I. L. Caskie, Ph.D., Robin Hojnoski, Ph.D., Patricia H. Manz, Ph.D., & Kristen Missall, Ph.D. Defended: August 2013
July 2012	**School Psychologist** – Louisiana State Provisional Certification
March 2011	**School Psychologist -** Pennsylvania State Certification
May 2008	**Master of Education, Human Development** Lehigh University, Bethlehem, PA Master Level GPA: 4.0 Qualifying Project: Predictive Validity of the Individual Growth and Development Indicators Committee Members: Edward S. Shapiro, Ph.D. & Grace L. Caskie, Ph.D. Project Passed: November 2008
May 2003	**Bachelor of Arts, Major: Psychology** Tufts University, Medford, MA GPA: 3.7, *Magna Cum Laude* Major/Track: Psychology/Clinical Concentration: Spanish **Honors:** A. Raymond and Eileen Tye Scholarship 1999-2003 Dean's List 1999-2003
June 2002	***Universidad Autónoma de Madrid*** One Year Advanced Immersion, Language and Culture Diploma of Spanish as a Foreign Language*, Intermediate Level*

Clinical Experience

Supervised Graduate Placements

Jul 2012 – Jul 2013 **Pre-Doctoral Internship, Psychology**
Louisiana State University Health Sciences Center (LSUHSC), New Orleans, LA
Louisiana School Psychology Internship Consortium (LAS*PIC)
Supervisors: Scuddy F. Fontenelle, III, Ph.D., A.B.P.P., L.P. & George Hebert, Ph.D., L.P.
*Provide psychological services in assessment, evaluation, treatment, consultation, and behavioral health prevention programming through Louisiana School Psychology Internship Consortium (LAS*PIC), Jefferson Parish Schools, New Orleans Speech and Hearing Center (psychological/behavioral services), and Louisiana School for the Deaf and Visually Impaired; active member of interdisciplinary teams; didactic training received through the LSUHSC across areas including (but not limited to) biopsychosocial approach to case conceptualization, interdisciplinary approach to care, health promotion and intervention, and assessment procedures (e.g., Autism Diagnostic Observation Schedule).*

Jul 2010 – July 2011 **Psychology Trainee, Fifth Year Placement**
Sleep Clinic, The Children's Hospital of Philadelphia, Philadelphia, PA
Supervisors: Jodi A. Mindell, Ph.D., C.B.S.M. & Melisa Moore, Ph.D., C.B.S.M.
Member of an interdisciplinary pediatric sleep disorders clinic, including pulmonologists, neurologists, psychologists, medical residents, and sleep fellows; participate in the evaluation and treatment of infants, children and adolescents with a variety of sleep disorders; provide regular outpatient treatment and follow-up to provide additional behavioral intervention.

Aug 2009 - Jun 2010 **Psychology Trainee, Fourth Year Placements**
Allentown School District, Allentown, PA
Supervisors and Collaborating Psychologists: Cynthia Ilgenfritz, Ed.S., Lourdes Sanchez, Ph.D., & Christine Novak, Ph.D.
Conducted comprehensive multidisciplinary psychoeducational evaluations to determine special education eligibility for children ages four through twelve; worked with bilingual/bi-cultural psychologist to complete linguistically and culturally appropriate assessments; completed functional behavior assessments and provided recommendations for intervention; collaborated with families, teachers, and other school and community personnel from various cultural backgrounds to develop interventions for the support of behavioral, social, and academic skill development.

Sleep Clinic, The Children's Hospital of Philadelphia, Philadelphia, PA
Supervisors: Jodi A. Mindell, Ph.D., C.B.S.M.
Member of an interdisciplinary pediatric sleep disorders clinic; worked with pulmonologists, neurologists, psychologists, medical residents, and sleep fellows; participate in the evaluation and treatment of infants, children and adolescents with a variety of sleep disorders; provide regular outpatient treatment and follow-up to provide additional behavioral intervention.

Supervised Graduate Placements (continued)

Upper Darby School District, Upper Darby, PA

Supervisors: Brenda Kabler, Ed.S., NCSP & Christine Novak, Ph.D.

Assisted coordinator of psychological services in Philadelphia suburb with implementation of Response to Instruction and Intervention programming for reading at elementary school level; collaborated with teachers and school personnel to assess and make intervention recommendations for elementary school students; conducted psychoeducational evaluations for high school students.

Aug 2008 - Jun 2009 **Psychology Trainee, Third Year Placements**

Out Patient Primary Care/Community Clinic – *Complex Care Clinic*

Lehigh Valley Health Network, Allentown, PA

Supervisors: Patricia H. Manz, Ph.D. & Rosauro Dalope, M.D.

Member of multidisciplinary team including pediatrician, nurse case manager, social worker, and registered dietician/nutritionist in outpatient clinic providing comprehensive, integrative care to infants, children, and adolescents with complex health care needs; connected families from various cultural and linguistic backgrounds with complex needs to community resources; provided brief caregiver education and consultation regarding student and parent legal rights, individualized education plans, and overall interaction with school systems; provided brief behavioral consultation to promote healthy behavior in children and families.

Out Patient Primary Care/Community Clinic – *ADHD Clinic*

Lehigh Valley Health Network, Allentown, PA

Supervisors: Patricia H. Manz, Ph.D. & Rosauro Dalope, M.D.

Conducted ADHD diagnostic evaluations as member of team consisting of pediatrician, nurse case manager, and university-based psychologist; facilitated communication among school personnel, medical personnel, and families to promote positive child and family outcomes; consulted with school personnel and families to conduct appropriate assessment and provide intervention recommendations.

Whitehall-Coplay School District, Whitehall, PA

Supervisors: Michelle Beck, Ed.S., NCSP & Robin Hojnoski, Ph.D.

Completed comprehensive evaluations including cognitive, achievement, curriculum-based, and behavioral assessment methodologies to determine special education eligibility and support student learning; evaluated students ranging in age from four to sixteen; incorporated progress monitoring data from Response to Instruction and Intervention (RTII) methodologies into psychoeducational evaluations; engaged in educational decision-making through Data Team participation in an RTII framework; participated in county trainings, meetings, and planning regarding District Safety and District Crisis Preparation Teams; provided short-term, individual psychotherapy for students with emotional and/or behavioral difficulties.

Course-based Practica

Jan 2008 - May 2008 **Psychology Trainee, Assessment and Intervention in Educational Consultation**

School Psychology Program, Lehigh University, Bethlehem, PA

Instructor: Edward S. Shapiro, Ph.D.

Participated in a one-semester didactic course and clinical practicum in the area of educational consultation; Practicum included use of curriculum-based assessment techniques to evaluate academic skill difficulties; Designed, implemented, and monitored effectiveness of a reading intervention for an elementary school student; Completed comprehensive written reports and communicated results to school and family.

Aug 2007 - Jan 2008 **Psychology Trainee, Behavioral Assessment**

School Psychology Program, Lehigh University, Bethlehem, PA

Instructor: Edward S. Shapiro, Ph.D.

Participated in a one-semester didactic course and clinical practicum in behavioral assessment; Clinical practicum required completion of two behavioral assessments including parent, teacher, and child interviews, direct observations, and the use of broad and narrow band informant report rating scales as necessary; Wrote reports based on assessment results and provided intervention recommendations to reduce problematic behavior and increase functional, appropriate behavior; Communicated results to school and family.

Jan 2007 - May 2007 **Psychology Trainee, Intellectual Assessment Practicum**

School Psychology Program, Lehigh University, Bethlehem, PA

Instructor: Kevin M. Kelly, Ph.D.

Developed skills in administration, scoring and interpretation of cognitive and achievement tests in a one-semester didactic and practicum course; Received training in the Wechsler intelligence tests (i.e., WISC-IV, WAIS-III, WPPSI-III), Wechsler achievement tests (WIAT-II), and the Woodcock-Johnson test of Achievement (WJ-III); and Completed four full battery assessments (one adult, two children, and one pre-school child).

Aug 2006 - Dec 2006 **Psychology Trainee, Consultation Procedures**

School Psychology Program, Lehigh University, Bethlehem, PA

Instructor: Robin Hojnoski, Ph.D.

Participated in a one-semester didactic course and clinical practicum in consultation procedures; The clinical practicum included conducting one formal consultation with a teacher; Procedures involved problem identification interview, problem analysis interview, problem evaluation meeting, data collection, development of an intervention menu, a summary report, and a case reflection; Consultation conducted for support of young student with Autistic Disorder.

Additional Supervised Clinical & Volunteer Experience

Jul 2005 - Jul 2006 **Behavior Specialist, May Center for Child Development**
Randolph, MA
Supervisors: Meredith L. Garrity, Ph.D., BCBA & Jane I. Carlson, Ph.D., BCBA
Provided consultation and oversight of behavior support plans in classroom and residential settings for children with severe behavior disorders and developmental disabilities; Implemented systems for monitoring clinical quality measures in evidence-based treatment program; Analyzed and implement functional behavior assessment protocols; Assisted with staff development and training; Participated in peer review and human rights committees.

Sep 2003 – Jul 2006 **May Center for Child Development - Peer Review**
Arlington, MA & Randolph, MA
Supervisors: Katherine Gilligan, M.S., BCBA, Meredith L. Garrity, Ph.D., BCBA & James K. Luiselli, Ed.D., ABPP, BCBA-D
Prepared student data for systematic presentation of clinically complex cases; Received doctoral level consultation and review of interventions and programming for students with severe developmental disabilities; Consistent progress monitoring in behavior change and skill acquisition;

Sep 2002 - Sep 2003 **Clinical Intern and Employee, SEEK Program, Kennedy School**
Somerville School District, Somerville, MA
Supervisor: David L. Harder, Ph.D.
Undergraduate internship program through Clinical Psychology Track at Tufts University; Assisted teachers in instructing children with diagnoses of various emotional and behavioral disorders; Provided classroom structure through prevention of and intervention in crisis situations; Participated in regular clinical supervisory meetings to discuss case progress.

Sep 2004 - Jan 2006 **Volunteer at Fenway Community Health Center Program**
National Support Line for Sexual Minority Youth and Young Adults
Boston, MA
Provided adolescents and young adults with referrals and information according to their particular needs, questions and concerns regarding Gay, Lesbian, Bisexual and Transgender issues (e.g., safer sex practices, prevention of sexually transmitted infections, HIV/AIDS resources, coping with bullying, overall social support and resource recommendations); Provided crisis counseling as necessary; Participated in bi-monthly clinical trainings and discussions regarding themes specific to volunteer concerns

Presentations and Publications

Publications

Leichman, E. S., & Mindell J.A. (2013). Behavioral Insomnia of Childhood. In: Kushida C.A. (ed.) The Encyclopedia of Sleep, Vol. 2, pp. 224-228. Waltham, MA: Academic Press.

Shapiro, E. S., Hilt-Panahon, A., Gischlar, K. L., Devlin, K., **Leichman, E. S**., Bowles, S. (2011). An analysis of consistency between team decisions and reading assessment data within an RTI model. *Remedial and Special Education.* doi: 10.1177/0741932510397763

In Preparation

Mindell, J. A., **Leichman, E. S.,** Puzino, K., Walters, R., & Bhullar, B. (in preparation). *Parental concerns about infant and toddler sleep.*

Leichman, E. S., Shapiro, E. S., & Caskie, G. L. (in preparation). *Examining the predictive validity of Individual Growth and Development Indicators on the Dynamic Indicators of Basic Early Literacy Skills.*

Paper & Poster Presentations at Scientific Meetings

Mindell, J. A., **Leichman, E. S.,** Puzino, K., Walters, R., & Bhullar, B. (2014, June). Parent questions submitted to an iPhone application for infant and toddler sleep. Poster to be presented at the triennial meeting of the International Congress of Midwives, Prague, Czech Republic.

Mindell, J. A., **Leichman, E. S.,** Walters, R., & Bhullar, B. (2013, October). An iPhone application for young children's sleep: Characteristics and concerns of users. Poster to be presented at the annual meeting of the American Academy of Pediatrics, Orlando, FL.

Mindell, J. A., **Leichman, E. S.,** Walters, R., & Bhullar, B. (2013, August). An iPhone application for young children's sleep: Characteristics and concerns of users. Poster to be presented at the annual meeting of the International Congress of Pediatrics, Melbourne, Australia.

Vilardo, B.A. & **Leichman, E.S.** (2013, April). Pediatric Psychology interventions and school collaboration: Trends in the literature. Poster presented at the National Conference in Pediatric Psychology, New Orleans, LA.

Mindell, J. A., **Leichman, E. S.,** Walters, R., & Bhullar, B. (2012, September). An iPhone application for infant and toddler sleep: Characteristics and concerns of users. Poster presentation at the Asia Pacific Congress of Pediatrics, Kuching, Malaysia.

Mindell, J. A., **Leichman, E. S.,** Walters, R., & Bhullar, B. (2012, October). An iPhone application for infant and toddler sleep: Characteristics and concerns of users. Poster presentation at the annual meeting of the American Academy of Pediatrics, New Orleans, LA.

Shapiro, E. S., Calhoon, M. B., & **Leichman, E. S.** (2011, July). *Training school personnel: preparing school psychologists to develop and facilitate Response to Intervention models.* Poster presented at the annual meeting of the Office of Special Education Programming Project Directors' Conference, Washington, DC.

Leichman, E. S., & DuPaul, G. J. (2011, February). *Psychological distress in caregivers of children with T1DM: A literature review.* Poster presented at the annual meeting of the National Association of School Psychologists, San Francisco.

Leichman, E. S., Bracaliello, C. B., & Manz, P. M. (2010, March). *School psychologists and medical care: Points of interface in primary care models.* Poster presented at the annual meeting of the National Association of School Psychologists, Chicago, IL.

Leichman, E. S. & Shapiro, E. S. (2010, March). *Predictive and diagnostic validity of Individual Growth and Development Indicators.* Poster presented at the annual meeting of the National Association of School Psychologists, Chicago, IL.

Leichman, E. S. & Shapiro, E. S. (2009, February*). Predictive validity of Individual Growth and Development Indicators.* Poster presented at the annual meeting of the National Association of School Psychologists, Boston, MA.

Gischlar, K. L., **Leichman, E. S.,** & Shapiro, E. S. (2008, October). *Emergent literacy assessment: Utility of the Individual Growth and Development Indicators.* Paper presented at the annual meeting of the Association of School Psychologists of Pennsylvania, State College, PA.

Shapiro, E. S., Benson, J. L., **Leichman, E. S**., & Solari, E. S. (2008, August). Validity of CBM Mathematics and measures assessing state standards. Poster presented at the annual meeting of the American Psychological Association, Boston, MA.

Leichman, E. S. & Garrity, M. L. (2005, November). *Reduction of maladaptive behavior via a token economy for a child with PDD.* Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Washington, DC.

Mencow, D. Y**., Leichman, E. S.,** & Cochran, M. L. (2005, November). *Assessing aggressive behavior across varying attention conditions in an FBA.* Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Washington, DC.

Gilligan, K. T., **Leichman, E. S**., Cochran, M. L. (2004, November). *Functional behavioral assessment: Evaluating interventions for multiple unsafe behaviors.* Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, New Orleans, LA.

Leichman, E. S., Mercincavage, L. M., & Cochran, M. L. (2004, October). The effects of escorts on escape-based tantrum behavior in a child with autism. In M.L. Cochran (Chair), *Examining the function of behavior in designing effective treatments for children with developmental disabilities.* Symposium conducted at the meeting of the Berkshire Association of Behavior Analysis and Therapy, Amherst, MA.

Gilligan, K. T., **Leichman, E. S.,** Cochran, M. L. (2004, October). Functional behavioral assessment: Evaluating interventions for multiple unsafe behaviors. In M.L. Cochran (Chair), *Examining the function of behavior in designing effective treatments for children with developmental disabilities.* Symposium conducted at the meeting of the Berkshire Association of Behavior Analysis and Therapy, Amherst, MA.

Research Experience

Jan 2010 - Present **Dissertation**

School Psychology Program, Lehigh University, Bethlehem, PA
Title: Predictive validity of the Individual Growth and Development Indicators in a sample of students who attend Head Start
Advisor: Edward S. Shapiro, Ph.D.
Investigating the predictive and diagnostic validity of a preschool emergent literacy measure on an early literacy measure in a group of students who attended a Head Start preschool program; Responsibilities include study design, development and implementation, data management and organization, data analysis, and presentation of findings.

Research Experience (continued)

Sep 2011 – Present **Research Associate, Consultant – Health Technology & Caregiver Concerns**
Johnson's Baby and GiantSky, Philadelphia, PA
Consultation for development of and research related to iPhone/iDevice Application targeting infant and child sleep. Research currently related to caregiver questions submitted to an Ask the Expert section of the application.

June 2007- Aug 2009 **Monitoring the Progress of Pennsylvania's Pupils (Project MP^3)**
Center for Promoting Research to Practice, Lehigh University, Bethlehem, PA
Advisors: Edward S. Shapiro, Ph.D. & Alexandra Hilt-Panahon, Ph.D.
Project investigated school-wide model for progress monitoring through Response to Intervention (RTI) in reading; Responsibilities included consultation with school personnel (i.e., reading specialists, intervention specialists, principals, and teachers) to support implementation of schoolwide RTI system, assistance with data and grade-level team meetings, aid in grade-, class-, and individual goal setting in relation to instructional decision-making; Further responsibilities included material preparation, assessment administration, data entry and organization, data analysis; Part of model demonstration grant funded by the U.S. Department of Education, Office of Special Education Programs (Grant # H326M050001).

Sep 2006 – Jun 2008 **Literacy Education and Readiness Now (Project LEARN)**
Community Services for Children, Lehigh Valley Head Start
Center for Promoting Research to Practice, Lehigh University, Bethlehem, PA
Advisors: Edward S. Shapiro, Ph.D. & Patricia H. Manz, Ph.D.
Project aimed to evaluate Early Reading First Centers within Head Start preschool classrooms; Responsibilities included preschool literacy assessment administration for English- and Spanish-speaking children, material preparation, training assistants to administer measures, maintaining relationship and collaboration with preschool Head Start teachers, data organization and entry; Assisted in data analysis, summarization, and presentation for final report.

Sep 2006 - Nov 2008 **Doctoral Qualifying Project Research**
School Psychology Program, Lehigh University, Bethlehem, PA
Title: Predictive Validity of the Individual Growth and Development Indicators
Advisor: Edward S. Shapiro, Ph.D.
Purpose of study was to determine the predictive validity of a preschool emergent literacy measure as assessed prior to kindergarten entry on early literacy measures administered during kindergarten; Responsibilities included study design, training for assessment administration, data organization and analysis, and written presentation of findings.

Sep 2009 – Present **Research and Development of Direct Academic Rating Scale**
School Psychology Program, Lehigh University, Bethlehem, PA
Advisors: Edward S. Shapiro, Ph.D. & Virginia Hampton, Ph.D.
Collaborators: Chris Riley-Tillman, Ph.D. & Sandra M. Chafouleas, Ph.D.
Member of research group to support the development of academic rating scales designed for standards aligned assessment of mathematics; Responsibilities include research, item development, and preparation for validation.

Research Experience (continued)

Aug 2006 - June 2008 **Study in Curriculum-Based Measurement in Elementary Mathematics**
Lower Nazareth School District, Co-Project Coordinator
School Psychology Program, Lehigh University, Bethlehem, PA
Advisor: Edward S. Shapiro, Ph.D.
Determined the predictive validity of curriculum-based measurement in mathematics to high stake state assessments as compared to district-created standards-aligned assessment; Responsibilities included maintaining relationship with school district, material preparation, training data collectors, data collection, organization, entry, and analysis, summary report to school

Sep 2003 – Jul 2006 **May Center for Child Development - Research Group**
Arlington, MA & Randolph, MA
Supervisors: Meredith L. Garrity, Ph.D., BCBA & Jane I. Carlson, Ph.D., BCBA
Clinical research area included assessment and treatment of individuals with developmental disabilities; Conducted and disseminated research in the form of posters and symposia at regional and national conferences; Mentored colleagues in research and presentation development.

Jun 2005 – Mar 2006 **National Standards Project, National Autism Center**
Randolph, MA
Supervisors: Joseph N. Ricciardi, Psy.D., ABPP, BCBA
Participated in project to establish standards for effective practice in educational and behavioral treatment/interventions for youth with autism; Secured and reviewed articles from a variety of professional and academic journals; Completed forms regarding articles for the development of national standards of practice.

Teaching & Supervision Experience

Sep 2009 – Jul 2012 **Personnel Preparation in Response-to-Intervention, Project Coordinator**
School Psychology Program, Lehigh University, Bethlehem, PA
Co-Principal Investigators: Edward S. Shapiro, Ph.D. & Mary Beth Calhoon, Ph.D.
Coordinate personnel preparation grant aimed to train Education Specialist (Ed.S.) level School Psychologists in Response to Instruction and Intervention (RTII) methodologies; Grant focuses training on core components and advanced implementation of RTII; Maintain communication with onsite supervisors; Monitor progress of practicum-level trainees to ensure project goal attainment; Coordinate production and dissemination of training videos on RTII focusing on prevention.

Jun 2009 **Invited Speaker: The Diagnosis and Treatment of Autism & PDD in Primary Care**
Department of Family Medicine, Lehigh Valley Health Network, Allentown, PA
Conducted lecture to medical residents of family practice on identification and treatment of children with Autistic Disorders and other Pervasive Developmental Disorders in the primary care setting.

Jan 2009 – Jun 2009 **Tutor for undergraduate student - Developmental Psychopathology**
Muhlenberg College, Allentown, PA
Provided individual tutoring and instructional modification for undergraduate student with hearing and language impairment.

Teaching & Supervision Experience (continued)

Aug 2008 – Jul 2009 **Didactic presentations to Complex Care Clinic Team**
Lehigh Valley Health Network – Complex Care Clinic; Allentown, PA
Supervisor: Rosauro Dalope, M.D.
Delivered presentations to multidisciplinary team (i.e., physician, nurse case manager, registered dietician/nutritionist, and social worker regarding school) regarding pertinent school and family related issues for children with particular chronic illnesses.

Jan 2004 – Aug 2005 **Senior Teacher and Supervisor**
May Center for Child Development, Arlington, MA
Supervisors: Katherine T. Gilligan, M.S., BCBA & Meredith L. Garrity, Ph.D., BCBA
Managed and supervised classroom schedule for staff and students; Classroom served children ages three through seven years with severe developmental disabilities; Created and implemented annual Individualized Education Plans as well as short term objectives for teaching procedures; Wrote comprehensive behavior support plans for students including specific antecedent and consequent strategies; Participated in clinical meetings in order to deliver case presentations including data interpretation and empirical information; Trained classroom staff in case management responsibilities, teaching methods, behavior procedures and school policies; Maintained responsibilities outlined below as teacher.

Sep 2003 – Dec 2003 **Direct Care Specialist/Teacher**
May Center for Child Development, Arlington, MA
Supervisors: Katherine T. Gilligan, M.S., BCBA & Meredith L. Garrity, Ph.D., BCBA
Implemented principles of applied behavior analysis throughout highly structured school day; Offered direct care and instruction to students with developmental disabilities within intensive pre-school program; Collected data on students' behavior and skill acquisition in order to analyze progress; Facilitated parent-teacher interactions and communication.

Jan 2002 – June 2002 **Teaching Assistant & English Conversation Class Leader**
Universidad Autónoma de Madrid, Spain
Facilitated weekly English conversation classes at University for Spanish undergraduate English majors; Created catalogue of activities for future program interns; Tailored lessons towards assisting students in succeeding in the oral portion of examinations.

Specialized Coursework & Training

June 2013 **Crisis Intervention and Recovery:** The Roles of School-Based Mental Health Professionals PREPaRE 2, National Association of School Psychologists
Dr. Bonnie Nastasi & Dr. Stacy Overstreet, Tulane University, New Orleans, LA

Mar 2013 **Crisis Prevention and Preparedness:** Comprehensive School Safety Planning PREPaRE 1, National Association of School Psychologists
Dr. Bonnie Nastasi & Dr. Stacy Overstreet, Tulane University, New Orleans, LA

Jan 2013 – Jul 2013 **Webinar and Online Professional Learning Development**
Dr. Alan Coulter, Louisiana State University Health Sciences Center, New Orleans, Louisiana

Specialized Coursework & Training (continued)

Jul 2012 – Jul 2013 **Didactic Sessions in Psychological Applications**
Louisiana State University Health Sciences Center, New Orleans, Louisiana

Aug 2009 – Aug 2011 **Didactic Sessions in Pediatric Sleep**
Division of Pulmonary Medicine, The Children's Hospital of Philadelphia

Aug 2009 – Dec 2009 **Health/Pediatric Psychology**
School Psychology Program, Lehigh University, Bethlehem, PA
Instructor: George J. DuPaul, Ph.D.

Aug 2008 – Dec 2008 **Comprehensive School Health Programs**
School Psychology Program, Lehigh University, Bethlehem, PA
Instructor: Edward S. Shapiro, Ph.D.

Jan 2010 – May 2010 **Seminar in Grant Writing and Preparation**
School Psychology Program, Lehigh University, Bethlehem, PA
Instructor: Lee Kern, Ph.D.

Jan 2009 – May 2009 **Structural Equation Modeling and Longitudinal Data Analysis**
School Psychology Program, Lehigh University, Bethlehem, PA
Instructor: Grace L. Caskie, Ph.D.

Jan 2008 – Jun 2008 **Seminar in Response to Instruction & Intervention (RTII)**
School Psychology Program, Lehigh University, Bethlehem, PA
Instructor: Edward S. Shapiro, Ph.D.

Jan 2005 **Picture Exchange Communication System (PECS) Training**
Certificate of Completion
Instructor: Pyramid Educational Consultants

Professional Activities

Memberships & Service

2011-2013 National Association of School Psychologists, *Annual Convention Proposal Reviewer*
2008 - Present Graduate Student Affiliate, American Psychological Association
2006 - Present Student Affiliate, National Association of School Psychologists
2004 – 2007 Student Affiliate, Association for Behavioral & Cognitive Therapies

Aug 2007 - May 2008 **School Psychology Doctoral Student Representative to Faculty**
School Psychology Program, Lehigh University, Bethlehem, PA

Sep 2004 – Sep 2006 **Tufts University Alumni Admissions Program**
Tufts University, Medford, MA
Interviewed prospective Tufts University undergraduates; Submitted written reports on students to formal admissions committee; Assessed students' potential compatibility with Tufts University.

References

Edward S. Shapiro, Ph.D.
Professor & Director
Center for Promoting Research to Practice
Lehigh University
Iacocca Hall, Room L-111-A
111 Research Drive
Bethlehem, PA 18015
(610) 758-3258
ed.shapiro@lehigh.edu

Jodi A. Mindell, Ph.D., CBSM
Professor of Psychology & Director of Graduate Program
St. Joseph's University
Associate Director
Sleep Disorders Center
The Children's Hospital of Philadelphia
5600 City Avenue
223 Post Hall
Philadelphia, PA 19131
(610) 660-1806
jmindell@sju.edu

Christine Novak, Ph.D.
University Clinical Supervisor
Professor of Practice
College of Education
Lehigh University
Iacocca Hall
111 Research Drive
Bethlehem, PA 18015
(610) 758- 3544
cgn208@lehigh.edu

George Hebert, Ph.D.
Internship (LAS*PIC) Coordinator & Assistant Professor
Human Development Center
School of Allied Health Professionals
Louisiana State University Health Sciences Center
1900 Gravier Street, 807/8A4
New Orleans, LA 70112
(504) 556-7566
gheber@lsuhsc.edu